MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF AN APPLICATION BY EACH OF
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES; and
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

August 22, 1975.

PROCEEDINGS AT INQUIRY

Volume 60

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APPEARANCES:

Mr. Ian G. Scott, Q.C. Mr. Stephen T. Goudge, Mr. Alick Ryder and Mr. Ian Roland	for Mackenzie Valley Pipeline Inquiry;
Mr. D. M. Goldie, Q.C. Mr. Jack Marshall, Mr. Darryl Carter, and Mr. John Steeves	for Canadian Arctic Gas Pipeline Limited;
Mr. Reginald Gibbs, Q.C. Mr. Alan Hollingworth	for Foothills Pipelines Ltd.;
Mr. Russell Anthony, Prof. Alastair Lucas	for Canadian Arctic Resources Committee;
Mr. Glen W. Bell and Mr. Gerry Sutton	for Northwest Territories Indian Brotherhood and Metis Association of the Northwest Territories;
Ms. Leslie Lane	for Inuit Tapirisat of Canada and the Committee for Original Peoples' Entitlement;
Mr. Ron Veale and Mr. Allen Lueck	for the council for the Yukon Indians
Mr. Carson H. Templeton	for Environment Protection Board;
Mr. David Reesor	for Northwest Territories Association of Municipalities
Mr. Murray Sigler	for Northwest Territories Chamber of Commerce

I N D E X

Yellowknife, N.W.T.,
August 22, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: I said yesterday that I'd rule on the motion that Mr. Gibbs brought to introduce evidence.

Foothills Pipe Lines has sought permission to introduce evidence that Canada has an urgent need for natural gas from the Mackenzie Delta and the Beaufort Sea.

This is a point of view that the industry has been urging in public. Indeed, Mr. Horte of Arctic Gas has been the leading spokesman of this side of the argument. He says that the construction of the pipeline is essential, and that it must begin immediately, because Canadian supplies of gas are running out. There is another side to this argument. Those on the other side say the pipeline is not necessary now, and need not be built for ten years. They say Canada would have sufficient gas if we did not export a large part of our production.

They are all entitled to argue the case in public, one side for the pipeline, the other against. That is their right as citizens of a free country.

The question then is whether it has been shown that this issue is one the Inquiry ought to consider.

My job and the job of the Inquiry is to consider the impact that this pipeline

will have in all its ramifications, if it is built. To do that I am bound to give the peoples of the north a fair hearing. I intend to do that, and to ensure that this Inquiry is fair and complete.

It is true that if the pipeline is built there will likely be enhanced exploration activity in gas fields and potential gas fields throughout the Western Arctic. So the Inquiry must consider the location and extent of the gas fields in the Mackenzie Delta, the likely extent of further gas exploration in the delta, the Beaufort Sea, and the Mackenzie Valley, and the impact that the development of the gas fields will have in the north.

But that is far from saying that the question of Canada's gas requirements for the 1980's is a matter that I should consider. It is not. It is a matter for the National Energy Board.

Nothing has been advanced that would justify this Inquiry examining Canada's requirements for natural gas. If we did, then we would have to go into the question of exports, since the extent of our future requirements is dependent upon our export policy. That is beyond the scope of the Inquiry.

I am to consider the impact of a gas pipeline on the north in all its ramifications, and to recommend the terms and conditions to be imposed if a pipeline is to be built.

It is for the National Energy Board to consider the question whether Canada's need for gas requires the building of a gas pipeline to

to bring frontier gas to market.

It will be for the Government of Canada when they have my report before them, and the National Energy Board's report, to weigh Canada's need for frontier gas, and the impact of the construction of a pipeline on the north and on northern peoples, and then to decide if a pipeline should be built, and if it is to be built, then where it should be built and who should build it. These are political decisions to be taken by those who have been elected to make such decisions.

So I'm not going to hear Mr. Mackie's evidence.

MR. SCOTT: Mr. Commissioner, I understand that this panel is the balance of the evidence Mr. Hollingworth has available for this week and next, and due to your ruling there may be a sudden exodus for the 10:45 plane. I just thought that as I had begun my cross-examination I should advise the panel at least that they are not going to make the 10:45 plane, that the best course in the circumstances is for them to just sit back and relax and see if they can't be instructed.

THE COMMISSIONER: Well, before you go ahead, I should say that I have a message here from the chief at Trout Lake:

"Please take our own food."

So all those who are going to Trout Lake tomorrow should be warned, bring your own food.

That probably goes for Nahanni

Butte as well.

E.A. MIROSH,
M.A. FAWCETT,
LEO BOUCKHOUT,
K. GILLESPIE,
C.W. DREW, JR., resumed:

CROSS-EXAMINATION BY MR. SCOTT (CONTINUED):

Q I'd like to begin by finding out something about the sequence of the process by which this route was selected, and Mr. Fawcett, I ask you to turn to your evidence at page No. 7, and question 11.

WITNESS FAWCETT: Yes.

Q In that answer you begin by describing the fact that your initial appraisal studies indicated that re-routing would be required at the northerly end and the southerly end, but that you generally accepted the 400-mile segment of route that Arctic Gas had adopted. Then further on at the top of the next page:

> "To aid Foothills personnel in defining the proposed pipeline corridor in two revised segments, government topographic maps at a horizontal scale of 4 miles to the inch were obtained. These, together with the Arctic Land Use series maps, supplemented with other related published material were used in conjunction with geological survey maps to select a preliminary route."

Now I take it that that was the material that you would have had before you at that very early stage.

A That is correct, sir.

Q And at about what time did you collect that material and have it ready to select a preliminary route?

A We had that when I joined the company, I procured the material from Ottawa and I had that available in October of last year.

Q In October of 1974. Well, then you go and I take it having got that material the next stage was to select a preliminary route?

A That is correct.

Q Were you going to select a route or a corridor?

A Our initial attempt on the mapping was to select a corridor.

Q So would it be correct to say that what you should perhaps have said there in the last sentence of that first paragraph is to select the preliminary corridor?

A Yes, I'd agree with that.

Q And the next paragraph I take it describes what you did with these maps. With all factors being equal the most economical pipeline route is the shortest distance between its originating and terminating stations as pointed out earlier. There are invariably, however, a number of constraints placed upon the locator which governs

the selection of the line between them.

Q Well, now, who was the locator of the preliminary corridor?

A I believe you could say that I was.

Q I see. Well, now, and I take it therefore that this preliminary corridor of 15 to 20 miles was selected at this stage in about October by you?

A That is correct, yes.

Q Well, now did you have any -- excuse me, the next sentence says, "These were discussed in the criteria description and when defined act as control points in route selection." Now, do I understand that when you had your maps and when you went looking for your 15 to 20 miles corridor, you devised some control point?

A That is correct, yes.

Q Well, now, what were the control points?

A I believe there were a number of them at the beginning. First of all, the physical control points, such as lakes, rivers, any indication that we had consultations with our environmental representative in Foothills, trapping zones, we had consultations with the geotechnical group as to the viability of the approach to the corridor to some of the areas of terrain that we passed over.

Q Well, let's just be a little more precise if I can. I take it that the

first thing you did after you had your map was you mapped a series of control points.

A That is correct. After consultation with the other groups.

Q All right. Now, in mapping these control points, who did the mapping of them?

A I believe that we set the control points first determining in the 200 mile, say at where the control points should be, deciding on that after consultation with the others.

Q All right. Well, were the control points things to be avoided?

A To be avoided or to be accepted.

Q All right, well, did you map the control points for the whole route?

A Yes, you could say we did.

Q Including the 400 mile segment?

A No, I will have to revise that. It was the northern 200 and the southern 200 we're looking at complete revisions on that.

Q All right, well now I take it that the contol points were selected by you?

A Not necessarily, as they were put down with the advice of some of our

consultants too.

Q Well, who else advised on the selection of the control points?

A We had John Ellwood originally drawn into our consultations as to the routing of these two segments.

Q All right, so there was yourself, there was John Ellwood, was there anybody else assisting in the selection of the control points?

A Yes, we had a representative at that time from Klohn Leonoff who assisted us indirectly.

Q Who was that?

A Dan Wasyluk.

Q Yes, and did he participate in the selection of control points?

A Not on the control points, just the verification of the corridor.

Q Well, I am just interested at the moment in the selection of the control points and I take it that you agree with me that this is fundamental, because once you've selected the control points, you vastly reduce your options, haven't you?

A That is correct.

Q All right, so it was you and John Ellwood, who else? Anybody else?

A I believe that was all at the beginning.

Q All right, and for the

400 route at the top and the bottom, did you map these control points?

A No, we reviewed it on the land series maps and just a general appraisal.

Q Well, did you ever list the control points?

A Yes, I think they were listed originally with CAGPL and we were involved with that particular studies at that time.

Q Well, Mr. Fawcett, you've told me that in October you and Mr. Ellwood determined the control points. Now, what I am anxious to know, can you tell me precieely what those control points were?

A. If we are talking about the northern and the southern 200 miles, I believe I can.

Q You can?

A I believe I can.

Q Do you have a list of them?

A Not at hand, but I could make a list of them, yes.

Q All right. How many were there, approximately?

A I couldn't say definitely at this time.

Q And I take it that that function was performed substantially by you and John Ellwood.

A Mainly, sir.

Q Yes. Well, did anybody else have any input into it?

A Not at the initial stage there wasn't.

Q All right. Well now, I take it as you say in the next sentence -- I'm sorry, in the next paragraph, that when you -- and I refer to the second sentence, that when you had established the control points, and I'm quoting:

> "As straight a route as possible was then established between them on the maps."

A That's correct.

Q Yes, and again when you

say "as straight a route as possible," do I understand you to mean as straight a 15-mile corridor as possible?

A That's correct.

Q Yes. Now who did that?

A I did.

Q And do you have a map that shows the corridor that you selected between the control points?

A Yes sir, we do.

Q Do you have that with you?

A No, I don't.

Q Perhaps that could be produced. Well now, I take it that once that was done, once your corridor had been selected by you, it was then flown by fixed wing aircraft.

A Yes sir.

Q Now do I understand from question 12 that the 15-mile corridor, having been selected in that fashion, and with that input, you then had to go onto to select a 3-mile corridor?

A Yes sir.

Q And to do that, as you say in the answer to question 12, you purchased some more maps on a more definitive scale.

A We did.

Q Yes, and I take it having got the maps, the maps you got were the maps of the 15-mile corridor.

A They extended beyond that, we got the full series of 50,000 mappings for

area which they have gone 100 miles each side of the corridor.

Q Yes, but the purpose of getting these maps was to examine more closely the 15-mile corridor that you had already selected.

A That's correct.

Q And I take it, as you say in the answer to question -- in the answer to question 12, at the top of page 9:

"Having got these maps, they were examined under a stereoscope."

A No, the photographs were examined under a stereoscope.

Q I'm sorry, photographs taken from -- of the 15-mile corridor.

A That's correct, yes.

Q And who did that work?

A I did initially for the corridor.

Q All right, and the purpose of this was to narrow the corridor down to three miles.

A Initially it was to establish the 15-mile wide corridor that we wanted to discern where the 3-mile corridor would fall within it, yes.

Q Yes, but you selected the 15-mile corridor with reference to your control points in the office.

A Correct.

Q You then overflew it.

A Yes.

Q You then got the maps and the photographs to give you a better view of the 15-mile corridor.

A That is correct.

Q You then took a stereoscope in order to get a 3-mile corridor.

A That's correct.

Q And you did the stereoscopic work initially.

A I did.

Q Well now, what can you learn from a stereoscopic examination of these photographs?

A I believe there are a number of things that can be -- that you can learn to appreciate your route selection or your corridor selection in our case. One of them was the approaches to different drainage crossings, different river crossings in some cases on the approaches to some hills. These were the features that I would be looking at initially for the corridor verification.

Q Well, I take it that a stereoscope simply, as Mr. Drew has said, I think, or someone has said in their answer, gives you the advantage that you would have if you hovered in a helicopter over the site.

A Yes, I would agree there.

Q And with the aid of that, you selected a 3-mile corridor.

A Yes.

Q Was anybody else involved in the selection of the three-mile corridor?

A No, there wasn't.

Q Well now, the three-mile corridor having been chosen, you then provided as you say in the answer to question 13, that corridor to Mr Drew.

A Yes, and to Klohn Leonoff.

Q And I take it that as Mr. Drew has told us he provided a terrain analysis of that three mile corridor.

A That is correct.

Q And do I understand that Klohn Leonoff also provided an analysis of that three mile corridor?

A In general yes. We surveyed the full 400 miles revision for Klohn Leonoff.

Q DId they provide an analysis of the three mile corridor before the final route was selected?

A I am not sure whether they were drawn in before that or not.

Q Did anybody else analyze the three mile corridor that you had selected?

A Just on our overflight that we had with other personnel.

Q Well, you had an overflight and you had the terrain maps that were an analysis of the three mile corridor, did you have any other kind of analysis by any other kind of expert of the three mile corridor?

A At that particular time we didn't.

Q I take it it was therefore, if I can take you to the top of page 10, it was on the basis of the three mile corridor that you had selected plus the terrain typing that Mr. Drew had done, thatyou determined a specific route

within the corridor?

A Yes, we did.

Q And I take it that that determination of that specific route was made by you?

A No, it wasn't entirely. It was initially made just as a straight lining on my opinion and then it was verified and revised by the other consultants.

Q Well, we'll come to the other consultants in a moment, but having got Mr. Drew's work, who drew the line on the map first?

A I did.

Q I see, and I take it that you did that with the assistance of your overflight and Mr. Drew's work?

A Yes, and again reviewing it in stereo for the particular alignment.

Q Yes, and at that point, with the stereoscopic work, Mr. Drew's work and your overflight, you were in a position to draw a specific route within the corridor?

A I guess you could call it that, yes.

Q And then I take it at that point you gave that specific route to your consultants?

A Yes.

Q And one of the con-

sultants you gave it to was the geotechnical people at Klohn Leonoff?

A That is correct, yes.

Q And one of the -- and I see thatyou also say that you gave it to the environmentalists at Lombard North.

A That is correct.

Q All right. Well, now when would you have done this?

A We originally initiated our corridor selection in November and we drew in John Ellwood in our early discussions. He contacted Lombard North and I am not exactly sure when he contacted them to have it reviewed.

Q Well, MR. Fawcett, just le t me follow. You told me that you were the man who drew the line after Mr. Drew's work had been done.

A That is correct.

Q And you then gave it to the environmental consultants and the geotechnical consultants.

A That is correct.

Q To be reviewed or confirmed.

A That is correct.

Q Well, now we have it that Mr. Drew didn't do his work, I think, until the beginning of January or later.

A That is correct.

Q All right, well, you wouldn't have drawn the line until you'd seen his work.

A No, that is correct.

Q All right, so when would you have drawn the line?

A We had it drawn and revised during January and I believe that the Lombard group had been approached and did appear at a meeting the first part of February.

Q But are you telling me -- maybe Mr. Drew could help -- are you telling me that his terrain analysis was ready in January?

A In portions, yes.

Q Was it done in sections and handed to you in sections?

A It was, yes.

Q So do I understand then that in drawing this line you would tak e a section of terrain analysis that Mr. Drew had done and draw a line on that and then pass it on to the consultants?

A That is correct.

Q And you would follow up with another section of line when it came from Mr. Drew?

A That is correct.

Q So I take it that at that stage there was never a whole line drawn the whole length of the route, there was simply bits that were handed from Mr. Drew to you, then to the

consultants.

A I don't believe we handed it to Lombard until we had the full 200 miles of the north selected, no.

Q But I would be correct in saying that what confronted the geotechnical people and the environmental people was a three mile corridor with a specific route in it that you had drawn?

A That's correct.

Q And their function was to comment or react to that.

A We asked them to do that, sir, yes.

Q What precisely did you ask the environmentalists of Lombard North to do?

A I didn't ask them myself but John Ellwood took care of that.

Q Do you know what John Ellwood asked them to do?

A Not exactly, no sir.

Q Well now, I take it that after the geotechnicians at Lombard North had looked at this and made their assessments, your next sentence indicates what happened.

"The reviews led to minor route adjustments."

A That's correct.

Q Did either of them make a report that recommended a minor route adjustment?

A They did.

Q Have you copies of that report?

A I have it at the office, yes.

Q Will you produce them both?

A I could produce the Klohn Leonoff. I assume that the Lombard made some

reports to John Ellwood, yes.

Q And you can produce those?

A I'm not certain if we can or not.

Q But let me see if I follow the situation up until now. You have selected the 15-mile corridor. You have refined it to a 3-mile corridor in the way you've described. Correct so far?

A That's correct.

Q You have drawn a line on the 3-mile corridor after looking at Mr. Drew's maps.

A Correct again.

Q Yes. You then get a geotechnical assessment and an environmental assessment that produced minor route adjustments.

A That's correct.

Q I put it to you, Mr. Fawcett, that with the exception of minor adjustments the line that was selected was selected by you.

A Initially, yes.

Q Subject to the minor route adjustments entirely.

A Correct.

Q I take it that as far as you know, no one else did any systematic mapping of the 3-mile corridor, except Mr. Drew.

A I don't think I follow you there, sir.

Q Well, were vegetation

prepared of the 3-mile corridor?

A I believe they were eventually, yes.

Q I did not ask you about eventually; I'm not interested in what was done after the event, I'm asking what was done before the line was drawn by you. Were there any vegetation maps of the 3-mile corridor?

A No, there weren't.

Q Were there any environmental maps of the 3-mile corridor?

A Just the ones that were existing with the Land Use series.

Q Just the Land Use series?

A That is correct.

Q None prepared by you or your people.

A No.

Q Were there any archaeological or any other plotting maps of the 3-mile corridor that you had available to you when you came to draw this line?

A I don't believe there was any in existence along the corridor.

Q And you didn't get any yourself?

A No, we didn't.

Q Well, I also suggest to you that before you drew the line on the map, you had decided to accept the 400 miles of Arctic Gas route

-- I'm not criticizing that, I'm simply suggesting that you had.

A I believe that we agreed that we would use it, yes.

Q And I take it, that having decided to accept the 400 mile segment, that very substantially dictated the location of the 3-mile corridor and the line.

THE COMMISSIONER: Excuse me, dictated the location of what?

MR. SCOTT: Of the 3-mile corridor, at the 200-mile end and the 200-mile bottom, and the line within it.

A I believe when you take a look at the map you will see that the middle 400 miles dictated a very narrow section of line that would control our termination of the northern 200-mile segment, and the originating point for the southern 200-mile segment. I don't believe that that restricted us in that sense. I believe that the actual physical land formation dictated the originating points for those.

Q And I take it that that is the way the route was selected that is shown on the map behind you?

A That is correct.

Q Yes, and you and the other members of the panel have described the process of verification that is currently this summer and this autumn under way.

A Yes sir.

Q Yes. Well now, Mr. Bouckhout, Mr. Fawcett has told us that beginning in January and on a sectional basis he took Mr. Drew's terrain maps, drew a line on them, and in sections passed them over to Lombard North, and I take it at this period of time you were at Lombard North.

WITNESS BOUCKHOUT: That's correct.

Q And is it correct that you prepared, as he says, an environmen tal assessment of those sections as they came to you?

A Essentially yes. Our initial input into it, of course, was collecting all the available information on the general area and working from the initial corridor maps, and in preparing our information we didn't restrict ourselves to a certain mile corridor, we went beyond on both sides.

Q Right, but what I'm getting at is you did a literature search of all the relevant literature that affected the Mackenzie corridor.

A Yes, we did.

Q And what you got from Foothills was a terrain map which had a line on it that was drawn by Mr. Fawcett, as described, and you would get that in sections.

A We didn't per se receive each terrain map. We received other maps with lines drawn on them.

Q I'm sorry, but what you did receive from Mr. Fawcett was a map which had a line on it.

A That's correct.

Q You would receive this in sections.

A Yes, I believe that's right.

Q Yes, and I take it that you made an environmental assessment in some fashion of the location of that proposed line to determine whether it was properly placed from an environmental point of view.

A Yes, we did, yes.

Q And you would do that again on a sectional basis.

A In the final run, of course, yes, it was done. Everything could be done at once, therefore we worked with what we had and then we acted on what came later.

Q And that led, as Mr. Fawcett said, to minor adjustments in the line.

A That's right.

Q Well now, was this all done when you were at Lombard North?

A Yes, I believe it was.

Q All right. Now who were the people and what were their disciplines that you had working with you at Lombard North assisting you

in this assessment?

A The disciplines included some mammalogists; do you want the individual names as well, sir?

Q Well, tell me the principal person in each discipline?

A The principal person in the field of mammalogy was Mr. Almer De Bock. The principal man in the field of birds was Mr. Bob Brown. The principal man in the field of fisheries, there were actually two fellows who were involved in fisheries work, one was Mr. Harry Blodgett, and the other was Dr. Alex Fedoruk. In the vegetation work the principal man was Mr. Norbert Kondla. We also had people directly with Lombard North working on the aesthetics section, which was Jim Taylor, and I believe, sir, that covers it from a direct input from Lombard North.

Q Were they all employees of Lombard North?

A Yes, they were, sir.

Q And did you make reports from time to time on the line that had been selected?

A I do not recall, sir, that we prepared formal reports as such. We had direct communication with Mr. Ellwood and were constantly discussing this but I don't recall making specific reports on these.

Q Well, Arctic Gas, in presenting their route, have been able to present us

with a detailed list of the adjustments that were made in the route for environmental reasons. Now, since Mr. Fawcett has told us that minor adjustments were made as a result of your environmental review, can you tell us what adjustments in the route Lombard North and you recommended?

A At that stage, sir, I cannot at the moment give you exact adjustments in the route, in terms of what changes were made in the route at that stage. I can give you a couple of examples of changes in the locations, etc., of ancillary facilities at that stage.

Q Well, I'm not concerned about ancillary facilities. Did you people recommend any changes in the route that Mr. Fawcett had selected?

A Yes, I believe we did.

Q Have you any list of them or any record of what they were?

A No, we don't I don't believe. I just have to refer that to Lombard North.

Q I beg your pardon?

A I'd have to refer that question to Lombard North. I don't believe that I am aware of any list per se of these proposed changes.

Q How many were there?

A I can't say, sir.

Q Yes, can you think of any examples?

A Yes, we made recommendations, one particular example would be the routing in the location of the Norman Range north of Norman Wells where the original route was fairly close to the Norman Range in that region.

Q And what was your recommendation?

A Our recommendation at that time was that if possible we would reroute some distance away from that range, but we would do that pending further field studies as well.

Q Why?

A Because of the sensitivity of the peregrine falcon, which species is known to nest in that particular area.

Q Is this the alteration referred to by Mr. Gillespie in his evidence?

A Yes, it is, this alteration which Mr. Gillespie has referred to is in reaction to our concern as well as in reaction to a hydrological concern as well and it is not firmly established exactly where that thing will be right now.

Q I take it, Mr. Gillespie, that you recommended that alteration for different reasons?

WITNESS GILLESPIE: That is correct, sir.

Q Your reasons were geotechnical in nature?

A That is correct.

Q Yes. Well, now, Mr. Bouckhout, can you recall any other adjustments that were made on your recommendation in the line that Mr. Fawcett prepared?

WITNESS BOUCKHOUT: At this moment, sir, no, I do not.

Q Do you recall any recommendations that you made with respect to adjustments that were not accepted?

A No, sir, I do not.

Q Perhaps Mr. Hollingworth can let me have a list of the adjustments that were made at this stage on the recommendation of Lombard North.

And I take it that since that time, Mr. Bouckhout, you of course have come to Foothills.

A That is right.

Q And that your work since that time has, as Mr. Fawcett I think described, been verification and field studies of the line that has been accepted.

A My work has been co-ordination of the input of the environmental consultants along this line.

Q Yes, but it is directed to verification of the line that is on the map behind you?

A Yes, it is directed to assessment of that line verification plus any recommendations that might be made in relation to that line.

Q Well, now, when did you come to Foothills?

A April 1, sir.

Q Yes, and are there any environmentalists on the staff of Foothills apart from yourself?

A I have one assistant.

Q Yes, and he is an assistant to you, is he?

A That is right.

Q Yes, and I take it that the environmental work that you require to have

done is in fact being contracted out to Lombard North?

A That's right.

Q Yes, and that the environmental consultants that are being utilized are substantially employees of Lombard North.

A I believe so, sir.

Q Yes. So it would be correct to say that unlike Arctic Gas, for example, as I understand their situation, at Foothills, all the environmental work has been contracted to one firm, rather than to a collection of experts from various offices or universities or firms.

A No, sir, I don't believe that is entirely correct, Lombard North has the bulk of the input into the biological part, however, we do also have other consultants who are involved in other fields.

Q Yes, but they are all employed or contracted for by one firm?

A No, they are not.

Q Who else do they contract?

A We have hydrological work being done by UNies Limited. We have air quality and climate work being done by Western Research and Development. We have archaeological work being done by Lifeways. We are having revegetation work being done by Dr. Vaartnou.

Q And are these directly under contract to Foothills?

A Yes, they are.

Q Have any of them made reports?

A Yes, they have.

Q Can those be produced?

MR. HOLLINGWORTH: Well, Mr. Commissioner, I am sure they will be produced. I am just wondering if this is the panel for them to be produced in. Mr. Scott has just asked Mr. Bouckhout about various kinds of consultants including consultants on subject matters which aren't remotely concerned with location.

MR. SCOTT: Mr. Commissioner, those reports should be on Foothills list of documents. They, as I understand, are not. Whether it is relevant here --

MR. HOLLINGWORTH: Well, there isn't a list at the moment, Mr. Scott. You are aware of that.

MR. SCOTT: Foothills like every other participant was obliged to produce a list of reports or studies within its possession or power. I would have assumed that any reports or studies of this type fell within that general category. If they have been overlooked I would like at the earliest possible time such reports as exist from all these advisors. Is it possible to have an undertaking that that will be done?

MR. HOLLINGWORTH: Well, I am not quite sure I understand you. We have said that we are going to comply as we know we must. It is just an oversight, with the requirement to supply a list of the documents relied upon by this panel and by succeeding panels. I think what you are asking me for is something different than that and that is a list of all the documents relied upon by Foothills, it seems that came from consultants outside of Foothills organization itself.

MR. SCOTT: Mr. Commissioner, I haven't made myself clear. I am not concerned just at the moment about any documents that this panel may be particularly relying on. What we have ascertained is that either Foothills or its environmental consultant , Lombard North, has received reports from a number of experts retained to give advice on matters from biology to archeaology. I don't understand that those reports have been listed on the production list that Foothills like all other participants had to produce. Now, I am not complaining about that, I am simply asking if at the earliest possible moment all those reports whether they were reports made to Foothills directly or to its agency Lombard North, should be produced for inspection.

MR. HOLLINGWORTH: I understand you now and I will look into it.

MR. SCOTT: Q Mr. Bouckhout, could I ask you to turn to page 16 and your answer

to question 31.

WIthout reading the first parapgraph it ends up by saying that a route was defined and do I understand from what you and Mr. Fawcett have said that the route that was defined at that stage of the process was the line that MR. Fawcett had provided plus the minor adjustments?

A Yes, I believe that is right.

Q And then you say in the next paragraph that you then moved into the second stage of the environmental studies.

A Yes, I believe I might clarify that a bit. Actually, as I see it now, there were really three phases. The initial phase would have been Mr. Ellwood's involvement with Mr. Fawcett in the identification of the original corridor and thé second phase would have been our reaction to that corridor, and a subsequent line and then the third phase would be the phase which we are now involved in which includes the field work and continued literature review.

Q Yes, Mr. Ellwood isn't on the panel, but you had no part to play with him in the selection of the origin al corridor?

A That's right.

Q Well, now let me turn to what you call in your evidence the second stage, and I take it that you say there in the third sentence, "We are currently conducting field

studies along the entire pipeline route".

Now, first of all, does that include the 400 mile segment that you have accepted from Arctic Gas?

A Yes, it does.

Q And what are these field studies?

A These field studies include site investigations by the biological field team where they are investigating their route location as well as the various locations of ancillary facilities. They are collecting some quantifiable data as well as making a general assessment of the location of the various facilities on the mainline route and they are also doing some fish work at the various stream crossings for our stream and river crossing locations.

Q Well, let me just see if I understand. I have some difficulty with those sentences. We are reading now, "We are curently conducting field studies along the entire pipeline route." NOw, stopping right there that suggests to me that the environmentalists are going out to study what they find in the field.

A Yes.

Q All right. Now, the next sentence seems to qualify that. "This is being done through a multi-disciplinary program. In this way the route is being evaluated simultaneously from both the physical and biological points of view?

A Yes.

Q Now, do I understand that the field study that you are talking about in the first sentence is in fact a multi-disciplinary program?

A The overall program is multi-disciplinary, however, the two aspects of it, the physical and the biological aspects of it are not totally integrated in that they are doing exactly the same things obviously.

Q Well, what do you mean when you say that in the course of these field studies the route is being evaluated simultaneously from both the physical and biological points of view?

A There sir, I am referring to the fact that Klohn Leonoff is undertaking studies in the field right now and we had set up the field program so that the biological crews and the geotechnical crews would be in close proximity and reacting to each others judgments on the various locations along the route.

Q All right, now, can you tell me what disciplines and persons are participating, representing the biological point of view in this multidisciplinary program?

A The prime disciplines representing the biological point of view are fish, birds and mammals.

Q And who are the people

who are doing it?

A As I said yesterday, the people who are involved in this are Mr. Brown, Dr. Paul Whitney, Mr. Hayden, Mr. Sopuck, Dr. Fedoruk and I believe a couple of others as well.

Q And who represent the physical point of view?

A The geotechnical consultant, Klohn Leonoff and as well, during the initial stages, Mr. Wally Drew, represented the physical points of view.

Q Mr. Wally --?

A Drew, who is a member of this panel.

Q Yes, I see, so the physical point of view is represented by the geotechnicians and the terrain analysis people?

A As far as the field investigations go, that's correct.

Q Well, how many field investigations of this multi-disciplinary team have been made?

A I don't know that I can actually number -- give you a number on how many field investigations have been made. I don't believe that's possible; it's a general investigation, it doesn't break down logically into numbers.

Q Well, let's see if I understand. I understand from this paragraph that what happened is a multi-disciplinary team goes out to some section of the route, and looks at it and makes decisions about it.

A The multi-disciplinary team started at the south end of the route, I believe, near the Alberta border, and worked their way progressively north, so it's a continuous process rather than a one-shot effort in site specifics.

Q All right, and when did it begin?

A This began in late May, I believe.

Q In late May, and how far north have they got?

A They have already completed the movement from the south to the north, and have moved from the north back to the south again, and another program is rapidly being established now

which will commence around about the 1st of September for another run along the line.

Q So what you're telling us is that the multidisiplinary team has covered the route twice.

A The initial multi-disciplinary team covered the route once from the south to the north. Beyond that during the second movement of the biological team from the north to the south, they did have contact with the physical portion of the team, however they weren't doing it as a joint effort. They simply maintained co-ordination and communication as they got separated by some distance. However, in the first phase of the program they did always stay together.

Q All right, well let's take the multi-disciplinary pass from south to north that began in May. Did Mr. Drew go on that trip?

A Yes, he was there.

Q Who went from Klohn Leonoff?

A I don't know specifically.

Q Well, perhaps Mr. Gillespie can tell us who went.

WITNESS GILLESPIE: I was on the trip, and Mr. Fred Claridge, another geotechnical engineer, was on the trip, and two geologists from Klohn Leonoff

Q How long did the trip take?

A Four weeks.

Q Four weeks, and you were constantly on the ground for four weeks.

A That's correct.

Q And Mr. Drew, you were there for four weeks?

WITNESS DREW: I was there about 25-26 days, from May 25th to June 20th.

Q I see, and I take it there were biologists as well?

WITNESS BOUCKOUT: Yes, that's right.

Q Well now, I've no doubt that this extensive review has produced a report and some recommendations.

A We do not have a report per se. The report, of course, will be prepared this fall and it will be a report which will cover all the summer field investigations.

Q Yes. When in the fall do you anticipate this report?

A That would depend on the various commitments of the staff this fall and winter, and in that I'm including the commitments which we'll have here at this Commission as well as other commitments at the National Energy Board.

Q Well, I take it, Mr. Bouckhout, that the environmental assessment that you've described earlier produced minor adjustments. It would be a fair observation, would it not, that

this environmental multi-discipline assessment might make major adjustments.

A This would be a possibility, yes.

Q Have we any idea as to when we may know when those adjustments on an environmental basis will be recommended?

A I would say we do know the areas right now which have been identified as potential locations for revisions, and we are already considering those.

Q All right, what are the areas where you anticipate there will be adjustments?

A I can point to possibly three areas at the moment. One area I've already referred to is the line on the west side of the Norman Range where we're still a bit concerned about our proximity to the Northern Range per se. Another area is the crossing of Smith Creek that's down near Wrigley, and we are looking at a revision there.

Q Why?

A The original line location crossed Smith Creek below a waterfall, and our environmental people have said that if at all possible they would like to re-route above the waterfall, since the location below the waterfall may have some fisheries significance.

Q Any other adjustment that occurs to you that may in the works?

A There is another possible

recommendation for an adjustment of the line south, immediately south and of the east channel crossing and including the east channel crossing.

Q Now, is that a complete list, or is that just off the top of your head?

A That's off the top of my head at the moment as to what I am definitely aware of at this stage. However, of course, there may be others coming in of which I'm not aware.

Q Perhaps you can let Mr. Hollingworth and Mr. Gibbs know if there are any others presently being considered, and what they are and other changes as they develop?

A Yes, I certainly will.

MR. MARSHALL: Excuse me, Mr. Scott, sir, with your leave I will take up Mr.Scott's invitation and join Mr. Mackie on the 10:45 flight. Mr. Carter will be carrying on through the day.

MR. HOLLINGWORTH: They can discuss gas supply on the flight, sir.

THE COMMISSIONER: Yes. Well, we will see you anon.

MR. MARSHALL: Of that I have little doubt, sir.

MR. SCOTT: Q Well, are you going to repeat this multi-discipline program in other seasons of the year?

A Yes, I believe we will, although we do not have plans firmed up as yet to do so.

Q Are you going to do one in winter?

A Yes, we are.

Q Are you going to do one at breakup?

A Yes, we will.

Q And I take it you recognize the necessity for a full environmental assessment of doing this work at those times as well as in the summer?

A Yes, I do.

Q So do I understand, therefore, that your work leading to a final line, will not be completed until after breakup next year?

A I think this is an on-going program, of course, and it's our work in reference to actual alignments on the ground will not be completed until the pipe is in the ground.

Q No, but I presume, Mr. Bouchkhout, that at some point you will be able to say that a complete environmental assessment at all relevant seasons of the year has been done.

A Yes.

Q Yes, and I take it that you won't be able to say that until you've examined the site at all seasons?

A Yes, this is also of course relative to what other information is available for the immediate area, and what season that subject information was gotten.

Q Well, I take it then that the earliest time at which you will be able to say that is following the breakup in '75. I'm sorry, in '76.

A I would say we will be continuing studies and particularly for the reasons that you have mentioned, we would like to have a look at the line location in these other seasons, which we have not been in the field in, and much of this will confirm what has already been produced as information on this basis.

Q Well, Mr. Bouckhout, I suggest to you that the major environmental input into your program results from your multi-disciplinary program, and the changes that may be produced by it.

A I don't say that this is necessarily the major input. This is just one of the methods that we have used to date to try and co-ordinate and make sure that everybody has a chance to look at the line then together.

Q Well, let me suggest this, that if any significant environmental changes in the route are going to be made, they are obviously going to be made as a result of this multi-disciplinary assessment that you're undertaking.

A They will be made as a result of the multi-disciplinary assessment which is undergoing this summer, as well as the result of any other studies which we will conduct this fall and winter.

Q And I take it, therefore, if that is going to be the major source of environmental modifications in the route, it's unlikely that that will be completed before the late spring or summer of 1976.

A We will not have completed all of our work until that time, but I don't think it necessarily follows that there is a great deal of chance that there will be more major input as far as -- well, not "input", let me rephrase that -- that there will be great recommendations for change as a result of work done in the other two seasons, namely the winter season and the early spring season.

Q Isn't that sort of pre-judging the effort?

A I don't think that's -- well, I suppose in a matter of speaking it's pre-judging; it's simply my own opinion; I'm certainly not going to stop the environmental people from making any such recommendations.

Q Well, if there are to be any but minor adjustments, such as Mr. Fawcett has told us about, they are going to be found as a result of the process you have now described as multi-disciplinary review.

A As I said earlier, sir, they would be defined by that process as well as by a process when the environmental people are alone in the field, when the geotechnical people are not

necessarily there. The multi-disciplinary program is a program which we carried on this summer, and it is not necessary to say, as I indicated earlier, that we would do that again throughout all the biological studies.

Q But the biologists aren't going to make changes in the route without consulting with the geotechnicians, are they?

A The change -- any changes made in the route by Foothills, of course would not be made by Foothills without having both groups involved.

Q Yes, so that what we may say is that as long as these teams are at work there is the prospect of substantial changes.

A Yes, I think there is always some chance of substantial change. We are always open to the possibility.

Q If there's no chance of substantial change, there is no point in doing it, is there?

A That's right.

Q So we must assume that that is why the work is being done.

A That's right.

Q Well, now I'd like to find out -- Mr. Marshall touched on this yesterday -- how this multi-disciplinary team works in the field. What happens when there are two competing interests that have to be resolved, when the geotechnician wants the line in place A, the fish man whats it in place B and the mammologist wants it in place C, what happnes?

A The actual process in the field is that either the physical or the biological team might find a particular site or a particular area which from their point of view could warrant a revision or a refinement of the route in that particular location. In that case, which ever team finds this particular point, that team would notify the other team and they would also be in a position then to assess it from their particular viewpoint. Beyond that the resolution lies with Foothills, not with the consultants.

Q Well, do I understand,

then that if the geotechnicians, which is the way you describe the physical people, and the biologists in the field are unable to agree on a revision, that it is dealt with by Foothills?

A Whether they are able to agree or not in the field, it is still dealt with by Foothills.

Q And who at Foothills has the power to determine whether this revision will or will not be made?

A The next phase of the process is that the biological team reports to me, the geotechnical team reports to Mr. Fawcett, and Mr. Fawcett and I then discuss the options open to us with respect to any possible refinements of the route.

Q Well, who decides?

A If we cannot at that point make a joint decision between the two of us, and in all cases I believe to date, we have been able to, in that case then it goes further and I would go to my immediate supervisor, Mr. Burrell and Mr. Fawcett goes to his immediate supervisor who is Mr. Mirosh.

Q So I take it that the biological input, let me put this situation, if the biologist in the field on a multi-disciplinary trip wants a change, he indicates that to you and indicates what the change should be?

A Yes, he would. He would

also indicate it to the geotechnical people in the field.

Q Yes, and the geotechnical people report to Mr. Fawcett that they either approve of or reject that change?

A That is right.

Q Yes, and then you and Mr. Fawcett debate it between yourselves?

A I wouldn't call it debate . We certainly discuss it.

Q And if you fail to agtee, what happens?

A As I said, if we fail to agree, then each of us takes our case to our immediate supervisor.

Q Has that ever happened?

A No, it has not.

Q No. Well, now when these changes are being debated, what is the standard by which the judgment is made?

A It is obviously a very difficult standard, there is no set standard, per se, it would depend on the assessed possible repercussions of both the revision as well as of the existing line as it exists.

Q Well, is there any other help you can give us on how these things are decided? Who gives way?

A I don't think we have as yet had any case where anybody had to give way. I

believe the philosophy of Foothills to date has been that where I can point to an area which does warrant a refinement of the route for a biological reason, that Foothills has to date accepted it as a reason and has accepted the revision.

Beyond that, not only do we confront biological matters with actual route location changes, but we have another option to confront these types of issues with various other protection measures which would include procedural measures during construction and operations and timing measures during construction. Therefore, I assess how we could possible cope with this problem, whether it is possible to cope with it from the point of view of these other protection measures or whether it is a necessity to cope with it from the point of view of location.

Q Well, do I understand that no environmental alteration that you have recommended has been refused?

A I don't think that that is necessarily true.

Q Well, tell me one that has been refused.

A I can't recall one to date, sir. We are looking at a number now and we haven't come to a final decision on these.

Q All right. Have any substantial environmental recommendaitons been made for a change?

A Other than at the first phase while we are still conducting the work in the office, the recommendations regarding the denning sites on the Thunder RIver and the Travaillant Lake area of course were accepted. As a result of field programs we are looking at possibilities right now, but we will wait for final decision on these until we get the full input from the consultants.

Q So that we can take it this way, that the effect of the environmentalists on the route so far has been restricted to the environmental assessment leading to the minor adjustments that Mr. Fawcett described. You may have an effect in the future, but that is the effect you have had now?

A No, I think that we can go a little bit further in that in that the effect we have had to date and I would point to the Holmes Creek instance as one, that the environmental people had suggested that there is a possibility there that we would be much better off to possibly refine the route in that location.

Q But that change hasn't been made.

A The change has not been made, however, the effect has been that the geotechnical people have actually initiated a drilling program in an area where we suggested, the joint geotechnical and environmental people suggested the refinement might be possible and we will be in

a position then by the information from the biological people and the geotechnical people this winter to make the decisions since we will already have the geotechnical information as well.

Q Well, let's just see if I can get this question right.

Apart from the minor adjustments done in the office, the environmental work has produced to date no changes in the route?

A As a result of the summer programs, if that's what you are speaking of.

Q As a result of anything.

A I would say, no -- has produced the result of no changes which have been finally accepted and drawn on the map and filed so --

Q So no changes to date.

A That is the interpretation, sir.

Q Well, now, Mr. Fawcett, I take it from what you have said that you have had no -- or I shouldn't say you, but Foothills socio-economic consultants have as yet had no input in the selection of the route?

WITNESS FAWCETT: A I believe that there has been a certain amount of considerations given to this, yes.

Q All right, who were your socio-economic consultants?

A I believe that Mr.

Burrell is heading up that section of the panel and I believe that he could answer that himself. I am not sure who he is using.

Q Well, Mr, Fawcett, you have told us how you picked the route, how you received the minor adjustments from the geotechnicians and the environmentalists. I take it that the socio-economists whoever they are played no part in that process because you didn't ddscribe them.

A Initially on the corridor section, no.

Q On the route selection that you gave to the environmentalists and the geotechnicians?

A I am not too familiar with what they had given to the environmentalists on that. I believe they work together as a team.

Q Well, Mr. Fawcett, you told us in your evidence that after the route had been drawn by you, as a result of Mr. Drew's work you gave the route on maps to the environmental consultants at Lombard North.

A That is true.

Q And you gave it to the geotechnicians at Klohn Leonoff?

A That is true.

Q Did you give it to anybody else?

A Yes, John Ellwood

discussed this, I believe with the other members of the environmental department who is John Burrell of course, his superior.

Q Did you give it to any socio-economist?

A I didn't, no.

Q Have you received any input from any socio-economist?

Any suggestion? Any change?

A Not as yet, no.

Q Not as yet and if you were looking for a change who would you expect to receive it from?

A Mr. Burrell

Q And you haven't had any suggestions from him yet?

A Not as far as the direct routing is concerned, no.

Q Not as far as the route, the main route is concerned.

A No.

Q Mr. Drew, in question 41 at page 24, you deal there, without reading it, of the importance of procedures for field verification of terrain typing and terrain sensitivity, and in the last part of your answer to question 43, which is on page 27, as I understand it, you refer to some of the results of the field checking that you have completed along the route. Do I understand the intent of those paragraphs when I summarize them that way?

WITNESS DREW: I'm not sure what your intent is.

Q Well, have I summarized them correctly?

A I think the summary is too brief for that long a paragraph.

Q Well, point one, you have emphasized, as I understand it, the importance of field verification of terrain typing and sensitivity.

A That is correct.

Q And you have given us some examples in your oral testimony and in the transcribed testimony in question 43 of the results that can be had from field checking?

A That is correct.

Q And I think you have indicated that field checking sometimes confirms and sometimes leads to minor modifications and sometimes leads to substantial changes.

A That is correct.

Q And you have found that field checking has done that not only for your work but accidentally and happily for Dr. Mollard's work.

A That is correct.

Q How much of the terrain typing along the route has been field checked?

A I was on this reconnaissance from May 25th to Jnne 20th, during which I field-checked the entire length of the corridor -- of the mainline corridor, from the Alberta border to the Arctic coast, and also the short lateral routes to the communities in the Mackenzie Valley. I have not yet looked at routes to Pine Point and Yellowknife, but intend to do so shortly.

Q Yes, and I take it that this field checking involves what?

A In my case the field checking involves -- well, first I prepare for it in the office. I select points on the photos where I feel that there apt to be exposures or apt to be problems, points that I wish to look at on the ground, and then we fly over the corridor in the helicopter and I try to land or have him land as close as I can to these points that I want to check, and then I go on the ground, I go to these points, I dig, if necessary , I pick up the material, I study it with a hand lens, I may taste it, I make a thorough examiation --

Q What do you taste it for?

A Because sometimes there

are certain salts, if I found salt licks, for instance, and to make sure they are salt I trust my tongue as well as my eyes.

Q If the R.C.M.P. saw you out there they'd probably arrest you.

A No R.C.M.P. are going to find me out there, the bush-whacking is too tough.

Q All right, well the essence of the exercise is picking out the points that you want to field-check and getting there.

A Well, also as I fly along I may see other things from the helicopter that I want to check, and yes, and I do get to these key locations as I said in my testimony. We map certain units and if I can check these units at key locations and see what their nature is, then I attribute those characteristics to other parts of that unit or other similar units.

Q How many spots did you field check?

A Just a moment, I'll look in my notes to see what my number is.

Q Yes.

A 170 on the first go-round.

Q And are you satisfied that no further field checking is required to be done?

A No, I am not. I am going to be doing the corridor again. I understand I have permission to do it again next month.

Q Yes, and how many stops

do you anticipate you'll make then?

A I don't know, but perhaps half as many to fill in the gaps, it depends upon the time and the weather.

Q Yes.

A And also just how many things I see that need to be checked, we'll be checking I think in the opposite direction.

Q Having in mind the impossibility of perfection, will that complete the necessary field checking of terrain typing?

A Well, I don't know, that of course is up to the client how long we go on with this. It will be in very good shape by then, but like you say, nothing is perfect and still you reach the point of diminishing returns. We could go out again next year and do some more and improve a slight bit, but whether there would be enough improvement to make it worthwhile, I can't say.

Q I see; and I take it that this checking has produced a fair number of changes in your terrain typing.

A Well, I'm not going to go through on the photos and revise all the terrain typing until I finish my field checking, then I'm going to do it all at once, rather than go through twice, just for economic reasons.

Q And I take it that what you contemplate when you do it is either changes or a range of modifications which will alter the terrain

map.

A That's only part of it. One of the main reasons is just to desrribe the units, and I want to see precisely what these units are made out of, what the characteristics are. I want to check their sensitivity in the field. I'm doing that as well as revising the interpretations. In other words, I'm trying to do everything when I'm there.

Q I take it that there was no checking whatever -- it was not possible to do any checking before the application was made.

A I'm not sure what date the application was made.

Q Well, the application was made in the spring of this year and I presume the alignment sheets had to be printed before that. I take it the alignment sheets that are in the application show none of the results of your checking.

A That is correct, those are the preliminary interpretations.

Q Yes. Now when will the final alignment sheets be ready?

A I couldn't answer that. The client would have to answer that.

Q Well, I take it that you regard yourself as having at least one more trip to make.

A I understand that I should have three more trips, a helicopter checking of the laterals to Yellowknife and Pine Point, a helicopter checking of the mainline and its short laterals off

of it, and motor vehicle checking of parts of the Yellowknife-Pine Points routes that are accessible to the road.

Q And even with respect to the extensive trip you've already made, none of those alterations or modifications in the terrain typing are before us?

A No, they aren't.

Q No. Are you able to give us any estimate as to when complete terrain type maps will be available?

A No. In the first place I don't call these maps, I call them photomosaics

Q I'm sorry.

A And I don't know when they will be available. Again that's up to the client to set the timetable.

Q Mr. Mirosh, are these check terrain type photomosiacs going to be filed in due course when they're ready?

WITNESS MIROSH: Yes, I think I could agree with that, they will be filed in due course. We haven't decided at what stage they will be filed at. It may be an intermediate stage.

Q Have you any timetable as to when we may expect to have the check maps?

A Off the top of my head, I would say within nine months.

Q Mr. Gillespie, in your evidence at page 33 you refer to the first reconnaissance

that your company conducted in January, 1975, as a result of which some revisions were made, and in the answer to question 51 you refer particularly to one of these revisions in the north and south approaches to the Willowlake River, and you say that the route was revised to avoid steep cross-slopes. Do I have that all correctly?

WITNESS GILLESPIE: That's correct, yes.

Q Now, that portion of the route is shown on alignment sheet 0500-01. Iwonder if you'd get that before you?

THE COMMISSIONER: Is it time for coffee? Well, let's stop for coffee.

(PROCEEDINGS ADJOURNED FOR 15 MINUTES)

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. SCOTT: Q Well, Mr. Gillespie, do you have this alignment sheet in front of you now?

WITNESS GILLESPIE: A Yes, sir.

Q Now, the route on the map is the heavy black line of course.

A Yes.

MR. HOLLINGWORTH: Mr. Scott, excuse me a moment, could I just have that reference again, please.

MR. SCOTT: To the alignment sheet?

MR. HOLLINGWORTH: Yes.

MR. SCOTT: Alignment sheet 0500-01.

MR. HOLLINGWORTH: Thank you.

MR. SCOTT: Q And the highway is the thin black line to the east, I guess -- I am sorry west of the line.

A That is correct.

Q Now, you told us that a revision was made at the Willowlake River to avoid steep cross slopes. Now, does this map show the line before or after the revision?

A Yes, the steep cross slopes I am referring to are on the north bank of the river approximately at mile 593 and

it's in terrain unit DR DF DR.

Q So that we will be able to identify that on the map, they are to the -- they are toward the top of the page above the line,is that correct?

A No, towards the lefthand side of the page. When I refer to north I sort of mean along the pipeline route.

Q I see . Well, now, does that show the revised line?

A Yes, that is the revised line.

Q All right, now can you tell me where the line was approximately before the revision?

A Yes, I think in that area it went, it probably passed a half inch towards the top of the page, that would be to the east, in a straight line.

Q So that at the point of crossing you are saying that the original line would be on the paper a half inch further up the river?

A No, a half inch further away from the river.

MR. HOLLINGWORTH: Maybe we should decide which river.

A Well, I am sorry, the Mackenzie River.

MR. SCOTT: Would you draw

the line --

THE COMMISSIONER: Well, wait a minute, isn't this the Willowlake River up here?

MR. SCOTT: Yes.

A Yes.

Q Do I understand that what you are describing is that if you begin at the left of the page at about mile 591 and take your finger up to the line, what you are saying is that you --

THE COMMISSIONER: Excuse me, let's do that again.

MR. SCOTT: Q Beginning at mile 591, Mr. Gillespie, can you show us where the original route went?

A It is approximately here. Starting at mile 591 in the north and ending about 594 in the south and this revision is on the north side of the Willowlake River. And the purpose of the revision was to avoid very steep side slopes and bedrock ridges which would have to be crossed by the pipeline.

Q Was there any alteration as a result of that in the river crossing at the -- of Willow River?

A No.

THE COMMISSIONER: NOw the original route that you have marked in pencil on the map before you, is that the route that

Arctic Gas still intends to use?

A I really don't know, sir.

MR. SCOTT: Q Well, now in the course of making that change, was there any environmental input?

A Not to my knowledge.

Q Mr. Bouckhout?

WITNESS BOUCKHOUT: A Not to my knowledge, sir, since this change was made prior to the field program.

Q Well, has that revision been reviewed or analysed?

A Yes, I am sure it has.

Q Well, now would you tell me at that area what are the points of environmental or socio - economic concern?

A I cannot tell you, sir, I am sure that our environmental consultants have looked at it, but I cannot personally tell you what the points of concern are there.

Q Well, do you know if there was any environmental concern about that change?

A No, I do not. But I am sure if there had been I would have been aware of it.

Q I beg your pardon?

A I just added that I am sure that had there been any environmental concerns as a result of our environmental people's

look at that particular area, I would have been made aware of it.

Q And you weren't made aware of any.

A That is correct

Q So therefore I may conclude that there were no environmental concerns expressed to you?

A There were none expressed to me as a result of the programs that had been carried carried out to date.

Q Would any socio-economic concerns be expressed to you or would that be handled by somebody else.

A They would not be expressed to me.

Q Did you ever hear about any of those?

A No, I have not.

Q Do you know the location of the site of Fort Alexander with relation to this line?

A No, sir, I don't.

Q Have you ever heard anything about how the line runs now in relation to Fort Alexander?

A No.

Q Have you ever heard of Fort Alexander?

A Yes.

Q Do you know where it is?

A No.

THE COMMISSIONER: Well, I have never heard of it, where is it?

MR. SCOTT: Well, it is located as I understand it on the north bank of the Willow-lake between the highway and the pipeline.

THE COMMISSIONER: Between the highway, between the line on the map.

MR. SCOTT: Between the line on the map which will be the highway, perhaps, and the pipeline.

THE COMMISSIONER: Perhaps.

MR. SCOTT: Perhaps.

Q What is the scale of this map, Mr. Gillespie?

WITNESS GILLESPIE: A This map is approximately one inch equals 2,500 feet.

Q So I take it at the point where the pipeline crosses the Willowlake it is approximately 2000 feet from the proposed highway?

A Yes.

Q Yes, and Mr. Bouckhout, did you ever hear that Fort Alexander was precisely at that junction?

WITNESS BOUCKHOUT: A I have never heard that, sir, however, our archaeological consultants will certainly be looking into that once we have defined the route in terms, of from the

environmental point of view in terms of putting the additional archaeological information into it.

Q Well, I take it that whatever you may do in the future, there has been no environmental assessment that relates to that juxtaposition of the highway, the line and this particular site, Fort Alexander?

A Our archaeological consultants have looked at this line and they have indicated I believe to date that there are no immediate changes to be made from an archaeological point of view.

Q They have expressed no concern?

A Not to my knowledge to me specifically, sir.

Q Yes, do you know anything about the location of historical grave sites on that particular portion of the route?

A Personally, no, I do not.

Q Have you ever heard anything from your archaeologists or anybody else about the impact of the pipeline and the proposed highway on those grave sites?

A Not personally.

Q Have you heard any complaints about the location of the line with regard to that?

A Not personally.

Q Do you know where the native people live in relation to this pipeline and the crossing?

A No, I don't

Q Have you any idea where the adjacent community is?

A No, I don't. I believe that is a matter for the socio-economic people.

Q Have you heard anything from the socio-economic people as to where the native people at or near this crossing live?

A I have not personally, no.

Q Have you made any assessment whatever in placing the line, and I presume approving the placement of the line there of the effect it may have on the wildlife or the people?

MR. HOLLINGWORTH: Well, Mr. Commissioner, I think Mr. Bouckhout has said again and again that he doesn't have anything to do with the socio-economic input. I think that is a fair question with respect to the wildlife, but I don't think it is with respect to the location of the community.

MR. SCOTT: All right, I withdraw the question.

Q Have you made any inquiries to determine where the domestic fishing done by native people is done at or near this crossing?

A Yes, we did do some

work on that during preparation of our submission and that work is ongoing now.

Q Well, where is it done?

A I cannot point it specifically, sir.

Q Have you heard any complaints about the location of the line with regard to the location of the native fishing?

A I have not heard any specific complaints, per se, sir, however, I could say that within our submission we indicate that we are continuing to upgrade our information according to the location of the fishing locations and we have said that we will avoid them,if we do not avoid them the final alignment there will be -- the final alignment and timing will be as a result of the discussions with the people who do fish in these locations.

Q Do you know anything about the location of a particularly important trapping area at or near the juxtaposition of the line and the river?

MR. HOLLINGWORTH: Well, again, I think this is a socio-economic matter, Mr. Commissioner.

MR. SCOTT: All right.

THE COMMISSIONER: I think it is on the line, isn't it -- forgive the expression, that trapping is an activity conducted by humans with the object of obtaining --

MR. HOLLINGOWRTH: Well, I think that it is on the line. It is a fair question to be asked if he knows if there is a fur bearing area in that vicinity, but I don't think it is with respect to areas of traplines.

MR. SCOTT: All right, let me ask you if you know anything about the location at or near the juxtaposition of the proposed line andthe river, of a proposed highway rest stop,that has to do with people.

A I do not specifically, sir. I would have to check with our consultants on that issue.

Q Have you heard any complaints about the location of the line bearing in mind the proposed location of that facility?

A To date I have not.

Q Do you know the location of a proposed recreational facility near the location of your proposed crossing in the river?

A No, I don't.

Q Have you heard any complaints about the juxtaposition of this crossing at Willow River and a proposed recreational area for people?

A I have heard no complaints to date. However, our consultants will be looking into this.

Q Yes.

A Further.

Q Well, Mr. Bouckhout, would it be fair to say with regard to this crossing that whatever work you will be doing in the future, and I am certain it will be extensive, there has been virtually no environmental analysis of which you are aware in this particular area.

A No, I don't think that's fair. I know there has been analysis of that area. I don't know if there has been analysis of those sites in particular.

Q Well, what does your analysis of that area tell us about the location of the route?

A I would think, sir, it tells us the relationship of the route to the broad wildlife areas in the region.

Q Well now, Mr. Bouckhout,

as I understand it, your input into route selection and the reason you're on this panel is because you are in charge of co-ordinating the analysis of environmental sensitivities in regards to the placement of the route, is that correct?

A that's essentially correct.

Q Now have you done as yet any analysis of the environmental sensitivities in this particular area?

A I could not say, sir, whether our environmental consultant, which is in the field right now, has in fact done so, but I assure you it will be done.

Q Well, I know it will be done, but has it been done? Have you had any input whatever into the location of this route at this place?

A From an actual site specific point of view, that would have to be left to further input from the summer program.

Q Have you had any environmental input whatever with regard to the placement of this line on the whole page?

A Yes, I believe we have.

Q I beg your pardon?

A I believe we have.

Q Well, what has your environmental input been, and what knowledge have you had of the area?

A Our environmental input as I indicated before, was from the point of view of

investigating existing literature when this particular route was being defined on a map, and of course there is a follow-up, and it is a continuing process.

Q Well, all right, I know it's a continuing process. I want to know now what your environmental people knew about this area? I've asked you four or five things that you didn't know about. What did you know about it?

A I cannot give you a specific list at this moment, sir.

Q Well, would that be typical of the extent of your knowledge on other frames in this series of maps?

A I don't know, I couldn't say, sir.

Q Well, let me put it to you quite frankly, Mr. Bouckhout, you had some input with respect to minor revisions about which Mr. Fawcett has told us, I put it to you that your environmental assessment is yet to be done.

A Certainly the site specific detail of our environmental assessment is being done.

Q Apart from the broadest analysis of the Mackenzie Valley, your assessment of this pipeline route as drawn by Mr. Fawcett is substantially yet to be done.

A I don't know what your definition, sir, is of "broadest". We have certainly concentrated on the location of the line right now, and

we have indicated that we are into the site specific stage now, and that certainly will not be completed just within the next month or two. We certainly intend to continue that process along.

Q Would you agree with me that your environmental assessment of the location of this route is a task that you're doing now and is not yet completed?

A I would say we are doing it now. We have done it, and I would agree that it's not completed, yes.

Q Well now, Mr. Fawcett, I refer you to question No. 17 on page 11.

WITNESS FAWCETT: Yes.

Q And in your answer there you refer to a number of meetings which were held with the Department of Public Works concerning the location of the pipeline in relation to the Mackenzie Highway.

A Yes sir.

Q And you say:

"A few conflicts between the two proposed routes "

that is the highway and the line,

"were solved."

Can you give us any examples of these conflicts?

A We had one conversation with them that changed the location of the proposed line at Saline River. They indicated that they would be putting the cut in on the south bank and our location crossed where they would be putting the cut in, I believe we moved away about 800 feet from that. We had a

conflict at the river between two mountains. We moved away about 500 feet. We had a conflict on a route change that they contemplated at Little Chicago, our last conversation with them that they would move away 300 feet to accommodate us in our location.

Q Yes. Now were these conflicts resolved in the actual meetings that you had?

A Yes, they were mutually resolved.

Q And who for Foothills participated in those meetings?

A I mainly.

Q Anybody else?

A Not on the meetings with them in Edmonton, no.

Q And so I take it that what happened is that you heard the differences and made a decision as to alteration.

A I was made aware of them and we discussed it when I returned, and we mutually agreed that we could make these changes.

Q Yes, well who did you discuss the m with?

A I discussed them with the oher groups at different meetings that we held in Foothills.

Q Well, did you discuss them with Mr. Bouckhout?

A I believe this was made before Mr. Bouckhout joined us.

Q Did you discuss them with any environmental consultant?

A I discussed them with our group meetings with John Ellwood and myself and a few of the others.

Q Well, what did the environmental people have to say about the Saline change?

A I'm not aware, if you're talking about in-house there was nothing said about it.

Q One way or the other?

A It would not produce any concern.

Q Was it asserted that that was a change that was satisfactory from an en vironmental point of view?

A It was satisfactory to us as a group, yes.

Q Was it satisfactory to the en vironmentalists?

A To our group environmentalists, yes.

Q Did they express any concerns about sensitivities in that area?

A No, the reason that we were attempting to move out of Little Chicago was because of an environmental sensitivity. The location of the highway would put us across some thermokarsting lakes and on this location we felt that we would like to have the highway moved further in so that we could

accommodate ours out of the thermokarst lakes.

Q Were any concerns expressed by your environmentalists about the sensitivity -- environmental sensitivities associated with that particular change?

A This was produced from that discussion that we had.

Q Are you talking about the Saline River?

A I'm talking about Little Chicago.

Q Well, let's talk about the Saline River. Did the environmentalists express any concerns about sensitivities in that area?

A Not to my knowledge, no.

Q Did the Department of Public Works and you discuss anything apart from changes that were rendered necessary because of engineering conflicts?

A Not to my knowledge, no.

Q Well now, I note that the community lateral, the major one that goes to Yellowknife and Pine Point apparently is to be suspended from four highway bridges, is that correct?

A This was one of the areas that we were looking at, yes.

Q Yes, and those bridges are at Rae, at the Kakisa River, and the Hay River and at the Buffalo River.

A That is correct, yes.

Q Have you had any discussions with any of the responsible government authorities respecting that mode of transporting gas?

A I believe that Mr. Mirosh might be able to handle that better. He carried that further than I did.

Q All right.

WITNESS MIROSH: Yes sir, we did have discussions with the Department and --

Q Which department is this?

A Department of Public Works, and we have obtained from them, drawings of their structural construction of the bridges. We have made preliminary designs for the crossings, and are in the process of submitting these to the department for their assessment.

Q All right, are they satisfied that the gas should be carried by the bridges in this fashion?

A In the discussions we've had to date, they've showed no apprehension.

THE COMMISSIONER: Showed no apprehension?

A Correct.

MR. SCOTT: Mr. Gillespie, I refer you to question 44 on page 27 where Mr. Drew referred to his terrain typings, and I think he said it was more reconnaissance type, faster, and an in-expensive tool providing the foundation for the more

detailed and exacting geotechnical soils and engineering studies upon which final decisions are made. I take it that you agree with that general observation?

WITNESS GILLESPIE: Yes.

Q And in your evidence you refer to some of the studies that you are doing. I see no mention of the preparation of a soils map of the route and facilities.

A Well, we have considerable amount of data from existing test hole information which is available to us, and at some later stage we will be doing additional drilling at site specific spots. At the present time we are drilling river crossings, some typical landslide areas, and some typical drainage areas. This certainly isn't the end of the drilling, it's really just an initial stage and there will be more drilling to confirm soil conditions in the various sections of the line.

Q Well, are you going to make a soil map of the route?

A A soil map as such? No. I really don't know what you mean by "a soil map", sir.

Q A detailed soil analysis of the route mapped.

A Well yes, we will be doing a detailed analysis of the route from the soils data. In some sections of the line there probably is sufficient soils information available. In areas of different types of terrain which could be classed as sensitive, there will be many addition -- or much more additional drilling required. In terrain types which perhaps could be classes as less sensitive, there probably is enough information available, there is, we know, a range of soil, ice, and characteristics in these different terrain types, and it's true that we may be doing more work on these things.

Q Well, let me ask you this. Are you going to do a sub-division of Mr. Drew's

map that shows the soils located from place to place along the route?

A No, I think that as Mr. Drew says, the terrain typing is really for reconnaissance, and I think as soon as we have a line pretty well established, we will be doing drilling in these various areas really to confirm terrain types, or to confirm soil conditions, and we're more interested from a geotechnical point of view in soil conditions rather than terrain types. We cannot design a pipeline and a facility, or do a stability analysis on terrain typing. We have to have the detailed information available, which can only come from drilling.

Q What did you mean when you said when you have the line established?

A Well, we're in the process of making minor revisions now, and I think that each drill hole that's put in, or each reconnaissance that is made will more accurately re-define the line, or define the line.

Q Mr. Fawcett, I refer you to question 25 on page 14 of your evidence, in which you describe in your answer, beginning at the top of the page the work that is under way that will be completed by the end of the summer. Is that correct?

WITNESS FAWCETT: That is correct.

Q Yes. Now, one of the things that you have under way that will be completed by the end of the summer is specific crossing sites of all

rivers and streams located along the proposed pipeline route. How many of those, approximately, are there?

A I believe there is about 32 in all, with about 12 majors, including 12 majors.

Q Are you suggesting that there are 32 rivers to be crossed the length of this pipeline?

A That would include the creeks and major streams, I believe.

Q Is that your information about the number of rivers that will have to be crossed from Alberta to the Arctic coast?

A That will require design, I assume I am correct in that.

Q None of the others are going to be designed?

A I think if you refer to Mr. Gillespie he might be able to tell you what their intentions are because he designs those.

Q The reason -- before I refer to Mr. Gillespie -- the reason that I am concerned is that in your evidence you say that:

> "Specific crossing sites of all rivers and streams located along the proposed pipeline route."

Now should that be amended to say that you're going to do that work with respect to how many?

A Your definition of "streams", perhaps it could be amended to the 32 that I referred to.

Q All right. Well, would it be correct to say then that you've selected 32 rivers for which you are going to do specific crossing sites by the end of the summer?

A I believe that this is correct, yes.

Q And in addition to that by the end of the summer you're going to have site specific locations of all ancillary facility sites.

A This is the wharf sites and stockpile sites that we're doing at the moment.

Q And construction pads?

A No, not construction pads.

Q Will that be done?

A That's on compressor stations which don't form part of the ancillary facility sites.

Q When is that going to be done?

A I'm not definite yet.

Q I beg your pardon?

A I can't be definite on that yet.

Q Well, that will not be done by the end of the summer?

A Oh no, not the compressor stations.

Q So by the end of the

summer we won't have any specific information on the precise location of the compressor stations.

A No.

Q How about borrow sites?

A No.

Q When are we going to get specific information on their location?

A I believe to have that confirmed would require a considerable amount of drilling, and this would be done at a later stage.

Q I am sure it will require a substantial amount of work, but can you tell us when the Inquiry and the Energy Board will receive specific information on the location of those borrow sites?

A I can't at this moment, no.

Q How many of the 32 rivers are going to be drilled?

A Could I refer that to Mr. Gillespie?

Q By all means.

WITNESS GILLESPIE: We're not proposing to drill 32 crossings during this period. We're drilling the major crossings which would control the location of the pipeline. These are the major control points, and I think there's probably eight or ten rivers being drilled in this program during this summer.

Q What, if anything, is happening at the other 24?

A Well, we don't consider these major crossings, we've looked at them on the ground and we do not consider there's any really serious geotechnical problem that could not be -- it will -- these minor crossings will not affect the location of the pipeline, is what I'm trying to say.

Q But I take it with respect to the eight rivers, you're going to drill in the summer, that at the conclusion of that exercise you will be able to define the specific crossings, as Mr. Fawcett has indicated.

A Right.

Q How about the other 24?

A Well, as I said, we've looked at these in detail on the ground and we do not consider there's a serious geotechnical problem there, and the crossings of these streams will be as shown pretty well on the mosaics right now.

Q When is the environmental input into the precise locations of these crossings going to be achieved?

WITNESS BOUCKHOUT: The environmental input into the precise crossings, of course, is partially under way right now. We are looking at the crossings as they appear on the alignment sheets, and where any revisions are suggested by geotechnical reasons or other reasons, certainly the environmental people will look at these new crossing locations.

Q Is that part of the

multi-disciplinary exercise?

A I suppose you would call it that in that environmental people would be reacting to the geotechnical people. However, it is not necessary that they both be on-site at that particular time.

Q Yes. How much drilling this summer will be done to ascertain the site specific location of ancillary facility sites?

WITNESS GILLESPIE: There is nothing planned at this time, sir.

Q Will that be done? Will plans for that be made later?

A Well, I can't really answer that but I think that I understand there are some plans available, or plans for additional drilling. But perhaps Mr. Mirosh could clarify this point.

WITNESS MIROSH: Yes sir, any facilities which we would plan to install will be drilled in the future. These will include stations, wharf-sites, stock pile sites, operations and maintenance facilities.

Q Well, Mr. Fawcett, you have told us that all that work is under way and that in addition further down on page 14, that you will be constructing new control mosaics , you will be doing low level photography of all river crossings.

WITNESS FAWCETT: That's true.

Q Does that mean all or 32 or 8?

A That means all that we have planned out of this 32.

Q Well, does it mean 32 or does it mean eight?

A I believe it's 32.

Q And that you will be doing interval contouring with respect to river crossing designs.

A That's correct.

Q How many river crossings?

A We're doing that on all 32 roughly, I believe.

Q Yes, and when is all this work going to be done and available?

A We have the photographies pretty well completed on the high level, which is the 1,000 foot river crossings are being done starting this next week. We contemplate going into orthophoto-mosaic construction about the 1st of October.

Q Well, I understood your evidence in transcribed form to be that this program was under way and would be completed by the end of the summer. When will the total program be available?

A I am not too sure on their construction scheduling, but I would assume it would be within six or seven months that we would have the finished ortophotomosaic products.

Q So what we may anticipate is that that information in total will be available, let us say, early in '76?

A It will, yes.

Q Well, now, Mr. Fawcett, I'd like to turn to the community laterals and I understand that of the community laterals by far the largest is the one to Yellowknife and Pine Point.

A In length do you mean, sir?

Q Yes.

A I would think so, yes.

Q that community laterals in fact occupy, what is it, 490 miles of which 460 miles is the Yellowknife one?

A That could be.

Q Yes, it is in that neighbourhood.

A Roughly.

Q Yes, and 480 miles is roughly half of your new route. More than half of your new route.

A I guess you could call it that way if you were taking the laterals as being comparable to a mainline route.

Q All right, the route

that is not the Arctic Gas route has 200 miles at the top, 200 miles at the bottom and approximately 490 miles of community laterals.

A I agree.

Q Yes, so that the community lateral project is a very substantial proportion of the different pipeline from the Arctic Gas application?

A Yes.

Q And I take it that it is a project that has been well publicized?

A I am not sure.

Q Well, now --

THE COMMISSIONER: Arctic Gas has heard about it.

MR. SCOTT: Q I take it, would it be correct to say that the process that you followed in selecting route, the mainline route, was followed in exactly the same way in selecting the community laterals?

A I think I'd reverse that. We did the mainline route first.

Q All right, well, let's take the Yellowknife community lateral as an example, as the most important one. Do I understand that the process of selecting a route was conducted in the same way as the process you have described in selecting the mainline route?

A Yes, it was done in the same way. I think this is true of a lot of the

tansportation system right-of-ways that we would be involved in. Initially this is done in all cases.

Q But you would in planning the Yellowknife lateral, have selected control points in the same way you have described earlier?

A That is true,

Q Yes, and you would have selected a fifteen mile corridor --

A That is true, also.

Q And you would have come down in the same way you described in a three mile corridor.

A I'll agree.

Q And then you would have come to Mr. Fawcett drawing a line on the map in the way you described with the mainline corridor.

A After we had the terrain typing, that was true, yes.

Q And you would have abng the way the same inputs.

A That is true also.

Q And when you had drawn the line on the three mile corridor to Yellowknife, you would have referred that line to Klohn Leonoff and the environmental consultants?

A This is true.

Q And did they make some minor adjustments with respect to that line as well?

A We've had the adjustments made by Klohn Leonoff given to us and we've incorporated them into the final routing.

Q Yes, and were they what we would call minor adjustments?

A I believe so.

Q And how about the environmentalists, have they suggested minor adjustments?

A It was referred to them and I believe that they are carrying ongoing studies to verify that.

Q Well, have the environmentalists made any revisions in your line to Yellowknife and Pine Point?

A Not as yet, no.

Q Well, Mr. Bouchkhout, what do you say about this?

WITNESS BOUCHKHOUT: A What Mr. Fawcett has said, sir, is true, we have not not made any revisions in the Yellowknife lateral line. We appreciate that the data base for that particular area is considerably less than the data base for the mainline and we are currently undergoing studies which I might indicate are much more intensive studies than for the mainline route to look at the location that has been drawn to date relative to environmental matters.

Q Mr. Gillespie, has any drilling been done on the Yellowknife lateral?

WITNESS GILLESPIE: A No, sir.

Q Is any proposed?

A Not at this stage, no.

Q Mr. Drew, have you already checked this section or is it one of the ones that you are going to do in the next survey?

WITNESS DREW: A No, this is one that is coming up very shortly. No, I have only checked the mainline and the short laterals from it so far.

Q Yes, so the terrain type checking on this portion of the lateral requires to be done.

A Yes, that's right.

Q When do you think that that will be done?

A September.

Q Well, MR. Bouckhout, has any preliminary analysis been made of the environmental sensitivities on the Yellowknife lateral?

WITNESS BOUCKHOUT: A We have looked at the routing, however, as I indicated, sir, the data base there is very skimpy and I might say that I am not confident that we have done the final job in that case and certainly we all appreciate that and are carrying on studies now to attempt to generate the data base which was necessary.

Q Are you satisfied with

the general routing?

A I could say that I am satisfied with the general routing from the point of view that Mr. Fawcett has done it, but I can't say that I am satisfied from the point of view that we have completed our environmental input into that routing.

Q Well, would you agree with me that for this 490 miles, over half of your new pipeline, a third of the entire pipeline, no environmental assessment has been made at all of any consequence to this stage?

A Yes, I would agree,

Q And that, I take it, is why there is no environmental material filed whatever with respect to the lateral?

A That is correct.

THE COMMISSIONER: The environmental assessment on the mainline has not been done either.

A I didn't say that, sir.

Q I thought you said earlier that that had not been done.

A Environmental assessment has been done on the mainline. It is a matter of getting down to site specifics and definition and I suppose it gets down to the semantic problem of what constitutes an environmental assessment. We certainly have assessed it from the data base and we are now assessing it from our field studies, so

it's a phasic process narrowing down to site specifics.

Q Well, didn't you agree with me, Mr. Bouckhout, that it substantially remained to be done on the mainline?

A I don't recall having agreed to the substantially to be done.

Q Well, let me ask you now, that apart from making some minor revisions to Mr. Fawcett's line, there have been no changes advanced or recommended or implemented by the environmentalists on the mainline.

A Since the line has been drawn, sir, we have not accepted any changes as such. I agree that much has to be done.

Q The business of advancing changes, negotiating changes or accepting Mr. Fawcett's line remains by the environmentalists to be done.

A Yes, I would say as a result of the summer programs, etc., yes.

Q All right, now, coming to the lateral you told us that there was no environmental volume and I take it that there is no environmental map filed either here or before the National Energy Board.

A That is correct.

Q The alignment sheets for the laterals show no geotechnical information whatever, isn't that correct?

A I would refer that

question.

WITNESS MIROSH: A That is correct, there was drilling done on that portion.

Q Yes, and there is no drilling done or shown on any map filed either here or at the National Energy Board.

A Correct for that portion.

Q And I take it therefore, it would be correct to say that for this 490 miles what you present to the Inquiry is substantially a line that Mr. Fawcett in his office has drawn on a map. Isn't that correct?

A Well, I believe Mr. Fawcett certainly has drawn the line. There had been discussions of routing with Mr. Fawcett and others, albeit of a preliminary nature.

Q But it's drawing a map in your office. No one's even set foot on it, have they?

A The program to investigate that portion of the line is being undertaken this September.

THE COMMISSIONER: Well, Mr. Mirosh, we understand that Foothills only recently filed its application, but we want to know where you are at in this thing and if you haven't anyone from Foothills set foot on the 490 miles of laterals -- lateral lines, we want that clearly understood if that is really where this thing has

gotten to. We know that you have got work underway and you are planning further work, but we are here to examine the impact that your line will have and we appreciate that you've opened up another area of impact by proposing these laterals.

Now, we understand the reason why Mr. Blair has put them forward, because he feels that the people of the North should be supplied with gas at rates subsidized by southern customers. We understand that from his evidence. But if those laterals are built, there will be an impact on the environment along an additional 490 miles and if Foothills has not had anyone on the ground along the route, we want to know that now so that we understand how far you have gotten.

A Sir, perhaps I could amplify a little bit more on what we have done. There have been over-flights of the route following preliminary drilling of lines on maps. There have been investigations of the river crossings by car, and that's how the decision resulted to consider crossing on the bridges; but as to detailed field work, that is coming up this September.

Q I take it that the location of the construction, the geotechnical problems associated with this lateral will obviously affect the cost of installing it. Is my question so obvious that it hardly needs to be answered?

A Yes sir, although I might explain that the Yellowknife-Pine Point portion of the line is the most o r the portion of our proposal which is most similar to that which we have faced in Northern Albertá. So that in a sense our concerns are not as great as they are in the portions where there is permafrost.

Q Well, what I'm concerned about is you may have observed that it has been asserted that persons at Yellowknife and other communities will save $500 a year for gas if the Foothills project is supported and approved. Now I put it to you that without knowing precisely where the line will go, how it will go, how it will be constructed, it's imprudent to say the least to make that kind of assertion. What do you say, Mr. Mirosh?

A. Well sir, we

have based our capital costs upon working with consultants who in turn have worked with a contractor to determine the implications of constructing that portion of the line, and as I have stated earlier, their opinion was that that line in majority is similar to what they are familiar with in Northern Alberta, so that in coming to capital cost assessments, it was not that imprudent of us to take that approach.

Q Do you think that the hard rock around Yellowknife looks like Northern Alberta?

A No sir, but there is rock in Ontario and these contractors and consultants have built through hard rock before.

Q Do you know whether or not there is permafrost along these laterals?

A I would suspect there might be some permafrost, but I'm not aware of it.

THE COMMISSIONER: Mr. Drew wanted to add something.

MR. SCOTT: I'm sorry.

WITNESS DREW: Yes, there are permafrost in places , in what do they call it, discontinuous permafrost zone, and of course they have had problems here in Yellowknife with buildings, because of permafrost in pockets between the bedrock hummocks There is also, I believe, isolated occurrences of permafrost in Northern Alberta and in Northeastern Alberta. Of course you have the Canadian Shield with hard rock just as you have here in Yellowknife.

THE COMMISSIONER: Yes, but

haven't built pipelines in North-eastern Alberta, have you? The Alberta Gas Trunk Line goes to the north-west sector of Alberta, but there's no permafrost there, is there?

WITNESS MIROSH: Well, sir, I'm not entirely certain but I would suspect that there may have been some permafrost on the line up to Zama and the permafrost may have been encountered in the line which Westcoast has built into the Northwest Territories.

THE COMMISSIONER: Well, do you mean the Pointed Mountain line?

A Yes sir.

THE COMMISSIONER: Yes, well that's another story.

MR. SCOTT: Q Mr. Bouckhout, you explained at one point, I think it was you in any event, that in your judgment your proposed south of fort Simpson route was preferable to Arctic Gas's because of something to do with the Ebbutt Hills. What was that all about?

WITNESS BOUCKHOUT: I don't believe, sir, that it was me who explained that particular point.

Q Well, I think somebody on the panel indicated that one of the virtues of the -- of your route adjacent to the Ebbutt Hills was that it didn't go through the Ebbutt Hills.

THE COMMISSIONER: Well, that was a proposed International Biological Program Preserve

as I understand it, and you sought not to cross the plateau, or you are remaining -- you're lengthening your line by 1 1/2 miles to go around the Ebbutt Hills and thus staying 750 feet below the plateau. I just want you to know I've been listening. That's right, isn't it?

Witness Mirosh A. That's correct.

MR. SCOTT: Well, do I understand that --

MR. HOLLINGWORTH: That was in Mr. Mirosh's evidence.

MR. SCOTT: Yes, it was, you are quite correct.

Q Have the environmentalists any views about that particular route as compared to the Arctic Gas route?

A Sir, are you asking myself or Mr. Bóuckhout?

Q Well, I'm asking either you or Mr. Bouckhout.

WITNESS BOUCKHOUT? Well, as regard s to our route location and relative to Arctic Gas' location, I don't recall having made a direct comparison of one with the other.

Q Well, Mr, Mirosh, what do you say?

WITNESS MIROSH: Well, sir I think in assessing our routing we wanted to consider those things which we felt were significant, or that we felt we should stay away from because of concerns

of others, and this particular I.B.P. site was brought forward to us by our own people who may have had input from their consultants advising us that it would be prudent for us to stay away from the I.B.P. site,which we subsequently did.

Q And when you in your evidence on page 4, in answer to question 5, say:

"We were advised by our consultants that a crossing of the Ebbutt Hills Plateau should be avoided as it is generally known that this area is a proposed International Biological Program site,"

who did that advice come from? Who were the consultants?

A Well, I think the advice came to us directly from our environmental department, and as I say, they were probably advised by their consultants, Lombard North.

Q Well, Mr. Bouckhout, is that the view of Lombard North, that you should avoid the Ebbutt Hills for that reason?

WITNESS BOUCKHOUT: Yes, I believe it was.

Q Is that in your view a justifiable policy approach to planning a route?

A I can't speak to a justifiable policy approach. It was our philosophy it would be a good idea to avoid it, if at all possible.

Q Yes. Well now, Mr. Fawcett, in drawing the laterals I take it you had

access to the land use maps.

WITNESS FAWCETT: Yes.

Q And indeed you essentially drew the line on the land use maps, didn't you?

A I believe the ones that we had available, yes.

Q Did you know that in drawing your line to Yellowknife and Pine Point you crossed through three I.B.F. or I.B.P. areas?

A I believe that Mr. Bouckhout is aware of one of them at least, anyway.

Q Well, are you going to -- you make a fuss about something that you did at the Ebbutt Hills, and on this lateral at Yellowknife you pas s through three I.B.P. areas, one of which is leased to the Univerisity of Alberta for a particular project.

A I believe that's true.

Q Well, are you going to do that?

A Yes, I think if we can carry it a little further, if we could, with Mr. Bouckhout, I believe he has looked into that.

WITNESS BOUCKHOUT: Yes, I believe personally that I am aware of the fact that we cross the Hart Lake I.B.P. site, which as you have indicated --

THE COMMISSIONER: What lake? Sorry.

A Hart.

Q Hart.

A Which, as you have indicated, is leased to the Department of Zoology, I believe it is, at the University of Alberta. I was not aware of that particular point at the time that Mr. Fawcett was drawing his map, however, subsequent to having found that out I have undertaken to discuss this issue with Dr. Fuller, who is in charge of that particular site, and I believe the reason it was made a site was because it was initially made an investigation field station because it is a representative wetland area, and as a result of that a great deal of information has been generated on that particular area.

I discussed this issue with Dr. Fuller, who is in charge of the Hart Lake Station and has great knowledge of the general Hart Lake region of that particular I.B.P. site, and we came to the mutual conclusion which I wouldnt say is a final conclusion, but which is a mutual conclusion that driving a pipeline across that site would probably be a good idea in that we had a very substantial data base from their initial studies, and would then be able to produce an analysis of what happens after a pipeline is put across.

Q They certainly will, there is no doubt about that. Were you aware of the other two sites that are mapped on the land use maps?

A No, I don't recall having seen those.

Q I trust as you'll be doing your work in the future, let me give them to you. There's site No. 22, map sheet 85-F, and site No. 49, map sheet 85-F as well, both at Falaise Lake.

A I might, sir, say that I have contacted the office of C.C.I.B.P., Panel No. 10, and they have provided maps with me and I'm not aware that on the most current maps that we actually do cross these particular sites. They have indicated to me that one or tw o of the sites in the region have been taken off the list as of recent.

THE COMMISSIONER: Well, just, could I -- at page 27, I think it was Mr. Drew said:

> "Virtually all of our lateral corridors are in new territory, some not even covered by the Geological Survey of Canada open file maps."

So that the situation you're in is drawing a line on a map, over-flying the line once you've drawn it, in territory that has never been surveyed by anybody for any purpose. Is that what you meant, Mr. Drew?

WITNESS DREW: Open file maps I am speaking of the surficial geology and terrain sensitivity open file maps. Now, there have been some very small scale bedrock geologic mapping done in that area and of course I know nothing about land use or biological maps and so forth. I am speaking of the surficial geology, open file and terrain sensitivity mapping.

Q Well, the Geological Survey of Canada is an institution that for fifty years has been conducting geological mapping of this vast country all over the place. If you are going to build a road or a mine or a pipeline or anything else, you always start with the work already done by this institution, isn't that what happens?

A That is correct. We did look at the bedrock geologic maps in this area, however there are very few bedrock outcrops except in the stretch from Rae to yellowknife where you are on the shield. In the other part, bedrock maps, this indicates there is quaternary cover or something but that isn't --

Q What cover?

A Quaternary.

Q Do you want to spell that.

A Q.U.A.T.E.R.N.A.R.Y. Those are the youngest geological deposits, the surficial deposits and so forth and of course we have to know not that something is quaternary, but what

it is, whether it is alluvial or a lake or just what
type of deposit and that information isn't published
or available for most of these long laterals to
Yellowknife and Pine Point which constitute most
of our lateral mileage. Therefore we didn't have
as much information to start with and had to depend
much more upon our judgment in interpreting the
air photos.

MR. SCOTT:
Q But Mr. Fawcett,
the land use maps are available, and you had them
when you drew the lateral to Yellowknife?

WITNESS FAWCETT: A I believe
that we had all of them. I am not certain whether
we did or not.

Q Well, if you didn't have
all of them, it was because you didn't ask for them.
They are all available, aren't they?

A Well, I assume that
they were available and we referred to them, yes.

Q All right. Well,
now, Mr. Bouchkout, what is the environmental view
going to be about these three I.B.P. sites?

WITNESS BOUCHKOUT: A Well,
sir, I think the environmental view is going to be
again as our philosophy in talking to the I.B.P.
people about these sites. As I have already indicated
I have talked to them about the Hart Lake Site and
we had discussed it in terms of the idea that it
probably would be a good idea to cross this. Now,
I am sure that in other cases for any other sites

which we do cross. If it is in fact our view that it would not be a good idea to cross these then we would certainly take measures to look at relocation around these sites.

Q I see, none of that has yet been done?

A No, it has not, sir.

MR. SCOTT: Those are all the questions I have, thank you, members of the panel.

THE COMMISSIONER: Any re-examination, Mr. Hollingworth.

RE-DIRECT EXAMINATION BY MR. HOLLINGWORTH:

Q Just a couple of questions Mr. Commissioner. Mr. Fawcett, in the cross-examination by Mr. Scott, the question of input from socio-economic advisors came up. I just wondered, it seems to be somewhat at odds with the evidence given by Mr. Mirosh, and I just wish you would clarify, was there any socio-economic advice given at all on the routing of the Foothills line?

MR. SCOTT: Surely that question has been answered.

THE COMMISSIONER: Well, I think that we'll allow it to be answered again then. Carry on.

MR. HOLLINGWORTH: Thank you, sir.

WITNESS FAWCETT: A In the

initial routing, if we may, we did concern outself with trapping areas both in the Travaillant Lake area and again around the Fort Simpson area. Initially we also looked at the compressor station locations of which we moved out of the Fort Good Hope area by six miles. We did have certain input that way, but in conjunction with this, we did have numerous meetings between the groups, of course we did have the socio-economic personnel with us and it resulted in the final location of the line as shown in our application.

Q And Mr. Mirosh, in the -- particularly in the cross-examination by Mr. Scott, there seems to have been a lot of emphasis placed on terrain typing, and then some discussion of the geotechnical aspects. I wonder, if for clarification, you might just give us some idea of the relative importance of the terrain typing as opposed to the subsequent geotechnical work.

WITNESS MIROSH: A Yes, sir. The terrain typing which we engaged the Sproule Company in was to allow us to prepare preliminary routing by using the sensitivity analysis that Mr. Drew has come up with. Subsequently of course Mr. Drew has been in the field and has been refining his terrain typing and we look at that refinement primarily to refine the corridor so that in the event that we have revisions that we wish to consider, lateral movements, we would then have a refined terrain typing analysis so we could again

look at a preliminary move if we had to do so. But in all cases we look upon terrain typing as a preliminary stage to be followed subsequently by site specific geotechnical information which includes both on site visual inspection and drilling. So for the design of the pipeline I would like to emphasize that it is the geotechnical input that we feel is important, whereas the terrain typing does help us define the preliminary corridors and routes.

Q One last question. Mr. Fawcett, I believe that you indicated to me that you were somewhat in error on your experience in South-western Ontario as to who you had been working for.

WITNESS FAWCETT: Yes, I think when that did come up I mentioned that it was Dome, and it should have been Union Gas.

MR. HOLLINGWORTH: Thank you, those are all the questions I have.

THE COMMISSIONER: Well, thank you very much, Mr. Drew, Mr. Fawcett, Mr. Mirosh, Mr. Bouckhout, and Mr. Gillespie. We appreciate very much your coming here to discuss these questions with us the last two days, and in sharing your knowledge and experience with us, and I know you will understand that it is Mr. Scott's job to ask the toughest questions he can think of, and that's the way we proceed in this Inquiry, and it's certainly no reflection on the regard in which we hold all of the witnesses who take the trouble to participate in the Inquiry. So this panel will be excused then, and I have no doubt we'll see you all again in September, at least most of you.

(WITNESSES ASIDE)

THE COMMISSIONER: Now, the formal hearings will be adjourned until Monday, September 15th, at one o'clock, when we will continue the presentation of the Foothills' evidence.

I want to make it clear, Mr. Hollingworth, that I expect that we will be working very hard throughout the week of September 15th and the

week of September 22nd to complete Phase 1, and to consider the evidence of all of Foothills' panels but I expect that they will be presented in the way that this one has, that is with regard to the differences between the Arctic Gas proposal and the Foothills proposal, and I am grateful to Mr. Gibbs and you, and to the panel, for having sought to highlight the differences in this evidence yesterday and today and not taking us back to Grade 1 and going through it all once again. Not that I didn't appreciate and enjoy the evidence of the Arctic Gas panels, but I'm making the point that we don't have to go through it all over again, and I'm interested in the differences so that when we return on the 15th, I want your panels to be ready so that we can work very hard throughout that week and the week of the 22nd and so that we can consider the differences as highlighted by the panels that you will be calling.

I am going to try very hard to complete Phase 1 in those two weeks because it's important that we should do so.

Now I'm going to ask Mr. Scott to consider with counsel a program that would involve the combining of Phases 2 and 3. It seems to me on reflection that it may well be that by combining those two phases it would be possible to avoid the duplication of evidence that we are likely to hear in Phase 2 in Phase 3 when we come to Phase 3, and since Phase 2 is a phase that I think we all expect will not take more than two or perhaps three weeks,

it may well be -- and I ask Mr. Scott and counsel to consider this so they will have an opportunity to confer when we reassemble on the 15th -- to consider the combining of those two phases.

But let me reiterate, Mr. Hollingworth, that we know that Mr. Gibbs and you have worked in very difficult circumstances to assemble the panels this week, and I didn't help you by choosing to give one of the panels, but we are going to have to ask you and the members of your panels to work very hard between now and the 15th -- that is three weeks -- so that we will have the panels ready to go and each ready to follow the other, even if that means that they have to sit here for a day or two before they are called upon. We are losing a week this coming week, and while no one really can object to having an extra week at the end of the summer, an extra week when one doesn't have to come here and listen to these panels, useful and worthwhile though that is, I really want to make up the time if we can.

Consistent, though, and I hope I don't ever have to reiterate this again, consistent with ensuring the right of Foothills to a fair hearing. But when we go to the communities we only have so much time, and that means that some of those people have to present their evidence at two o'clock in the morning, and if we can require ordinary people living in the communities to do that, we can require it of eminant profession people such as

the members of the panels.

So we will adjourn the formal hearings until Monday, September 15th at one o'clock, and the Inquiry itself is adjourned until tomorrow when we will convene at Trout Lake, that is tomorrow the 23rd; we will convene again at Nahanni Butte on the 24th; we will convene at Fort Simpson on September 8th and during that same week we will be convening hearings at Wrigley and at Jean Marie River as well, returning here on September 15th at 1 P.M. So we stand adjourned.

(PROCEEDINGS ADJOURNED TO SEPTEMBER 15, 1975)

MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTTER OF APPLICATIONS BY EACH OF
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES; and
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINES

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.
September 15th, 1975

PROCEEDINGS AT INQUIRY

Volume 61

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APPEARANCES:

Mr. Ian G. Scott, Q.C. Mr. Stephen T. Goudge, Mr. Alick Ryder and Mr. Ian Roland	for Mackenzie Valley Pipeline Inquiry;
Mr. D. M. Goldie, Q.C. Mr. Jack Marshall, Mr. Darryl Carter, and Mr. John Steeves	for Canadian Arctic Gas Pipeline Limited;
Mr. Reginald Gibbs, Q.C. Mr. Alan Hollingworth	for Foothills Pipelines Ltd.;
Mr. Russell Anthony, Prof. Alastair Lucas	for Canadian Arctic Resources Committee;
Mr. Glen W. Bell and Mr. Gerry Sutton	for Northwest Territories Indian Brotherhood and Metis Association of the Northwest Territories;
Ms. Leslie Lane	for Inuit Tapirisat of Canada and the Committee for Original Peoples' Entitlement;
Mr. Ron Veale and Mr. Allen Lueck	for the council for the Yukon Indians
Mr. Carson H. Templeton	for Environment Protection Board;
Mr. David Reesor	for Northwest Territories Association of Municipalities
Mr. Murray Sigler	for Northwest Territories Chamber of Commerce

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Yellowknife, Y.T.
September 15, 1975

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. SCOTT: Mr. Commissioner, welcome back to Yellowknife.

The first order of business this afternoon, before we continue with the Foothills' evidence, is a submission from the United Steelworkers of America. As you know, sir, the Yellowknife community hearings will be held in October, beginning in October, at a date yet to be fixed, the United Steelworkers of America are the bargaining agent for a substantial number of residents of the Territory, particularly in the Yellowknife area, and as a matter of convenience it was arranged for them to make their submission today, rather than later on, at the community hearing.

I would ask their representatives to come forward and sit at the table, and perhaps if Miss Hutchinson will take the oath of the principal spokesman, he can then introduce the representatives and they can make their submission.

MR. MARSHALL: Mr. Commissioner, I wonder if I might raise a point. Do I understand from Mr. Scott's remarks that we are finding ourselves today in the first session of the Yellowknife community hearings?

MR. SCOTT: I think it's fair to say that. What occurred, Mr. Commissioner, in this

particular instance, was as you know and as all the other participants know, the Yellowknife community hearings will be held beginning in our session in October, but during the evenings. As a result of an arrangement made with Mr. Waddell, it was thought more convenient for the Steelworkers, the bargaining agent of employees of Giant Mines and perhaps other places, to make their submission today, rather than at that time. Therefore, in that sense, we are having a short submission that would normally be heard at the Community hearing for Yellowknife.

MR. MARSHALL: Well sir, I appreciate that Mr. Waddell's got a busy schedule and it's difficult for him to keep us advised of everything, but I was advised about 15 minutes before coming into the hearing room that there would be a submission made, and I was handed a copy of a prepared brief.

Your rulings, sir, do set out certain procedural requirements to be followed at the formal hearings, albeit there are distinctions drawn between those who are major participants and those who are not considered as major participants, and so we have kind of ground rules laid down for the formal hearings. They are somewhat different from those for the community hearings, and particularly they relate to matters such as cross-examination and so on. I just wanted to have that clarified, if I could, and I'm afraid I still don't have it clarified as a result of Mr. Scott's remarks. Where do I find myself this morning, or this afternoon? AM I in a community

hearing or am I in a formal hearing, and if I'm in a formal hearing, am I expected to proceed with the cross-examination of this panel on such short notice?

MR. SCOTT: First of all, MR. Marshall, you're in Yellowknife. It's the time at which we anticipated that the formal session, to hear the continuation of Foothills' evidence would continue. We are taking a short break from the unrelieved excitement of those submissions to hear a community witness, which essentially is the situation in which the Steelworkers are today cast.

I would presume that the rules that attach to community hearing witnesses will apply here, though as I have indicated to you on other occasions, and I emphasize with respect to this submission, if you wish on a later occasion to ask any questions, I'll be happy to facilitate that for you.

MR. MARSHALL: Thank you very much, Mr. Scott.

THE COMMISSIONER: Well I laid down rulings about supplying briefs in advance, but they don't apply to the United Steelworkers. The rulings only apply to the main participants in this Inquiry. That much at least is clear.

I should tell you that Mr. Waddell spoke to me some weeks ago and he said the Steelworkers wanted to present a brief, and they wanted to do it today, at least I'm sure he must have said today, and I said that's all right with me, and that's really what happened. There's another group,

I think Mr. Waddell can tell you, that another group, another local group wanted to present their brief during the formal hearings, that is in the daytime, instead of in the evening, and I said all right to that, and I can't even remember who they were, Mental Health or something. I think we had better just carry on. I would like a copy of this brief.

MR. SCOTT: Mr. Commissioner, while I'm delighted to welcome the Steelworkers, might I suggest that from now on it will be a convenience to all the participants if community hearing witnesses are heard, where possible, at the community hearings, and if it is not possible, we will have to, in concert, make some particular arrangement to hear them, because apart altogether from time table, the role in which they appear may be misunderstood, but I'll try to make arrangements so that that is conveniently done in the future.

THE COMMISSIONER: Take it up with Mr. Waddell. He will consider your representation.

MR. SCOTT: Well that's what rather troubles me.

After that interchange, perhaps we should now hear the submission from The United Steelworkers of America.

THE COMMISSIONER: Please, be seated if you wish, don't feel obliged to stand up. It's only the lawyers who have to stand and even they don't always stand.

MR. STEVENS: Mr. Commissioner, let me first of all apologize on our behalf. It was our understanding from several meetings we've had in this area with our people, dealing with this question before us today, that we understood the community rules would apply and therefore we have not documented any of our evidence.

THE COMMISSIONER: They do apply so don't apologize.

MR. STEVENS: They do apply. So we haven't documented any of our evidence.

THE COMMISSIONER: They don't apply.

MR. STEVENS: They don't apply. At least, you haven't done anything wrong.

MR. STEVENS: You mean up to the present time. If the lawyers for the opposition want our brief to be documented, we would be prepared to give that evidence at a later period of time, or to supply it to them.

Would you like me to proceed now.

THE COMMISSIONER: Give us your name for the record.

MR. STEVENS: My name is H. Len Stevens, The United Steelworkers Area Representative for the Prairie Provinces and Northwest Territories.

THE COMMISSIONER· Could you give us the names of your colleagues?

MR. STEVENS: Yes, I will. Mr. Bob Garlick, President of the Northwest Territories Steelworkers Area Council, from Pine Point, on the right hand side.

Mr. Don Wilson, the President of Local 803, United Steelworkers of America.

Mr. Stewart Cook, Assistant to the Director of Unites Steelworkers for District Number 6, on my right hand side.

We have Ken Walldie, the Research Department, for the National Office, United Steelworkers. His home town is Toronto Ontario.

Forst Nendsa, Vice President Local 802, which is the Con Mine.

Ed McRaie who is our new staff representative, now making his residence here in the City of Yellowknife. That's our people appearing today.

THE COMMISSIONER: District 6 is Western Canada?

MR. STEVENS: District 6 comprises

everything from the eastern borders of Ontario to the western borders of B.C. encompassing the Northwest Territories and the Yukon.

Mr. Commissioner the Steelworkers Union is pleased to have the opportunity of addressing this Commission today. Our members have a special interest in the issues under consideration here. The U.S.W.A. represents most of the employees in the mining industry, which with over 220 million dollars in production last year, was the most important industry to the Northwest Territories. With almost 900 members in the Northwest Territories, our union is one of the most active labour organizations in the North. Most of these workers and their families are permanent residents of the Yellowknife and Pine Point areas, and they have an obvious long-term interest in the rate and type of development which occurs here.

Furthermore, our 185,000 members in the rest of Canada are employed in a wide variety of industries, most of which would be profoundly affected by any project of the scale which has been proposed. In particular, we represent 46,000 workers in the primary metal industry, another 50,00 in the metal fabricating and machinery.

For these reasons we felt it was essential that we take the opportunity of presenting to this Commission our views on this proposed development.

Along with many other groups which have presented their views to this Commission, our union is alarmed at the prospect of having the largest

development project in this country's history undertaken by private interests on a take it or leave it basis, without reference to Canada'a long term needs. This should not be taken to mean we are opposed to the ultimate development, exploitation of natural gas resources in the Mackenzie Delta. Rather. we believe that such development when it does take place, should be part of a comprehensive national energy policy designed to develop this and all other energy resources in the best interest of the Canadian people.

If we were dealing with a project of conventional proportions, in a competitive market, the prospect of having development undertaken by private interests solely for the purpose of private gain might give rise to less concern. If not clearly in the public interest, at least its harmful potential, if any, would not be seen as a risk of catastrophic and irreversible damage.

What we are dealing with here is not a project of conventional proportions undertaken in a competitive market. And although some benefits can be measured, there are staggering social costs involved which are completely excluded from the decision making process of the promoters.

The question of when and how to exploit these resources involves a complicated set of trade-offs. It is inconceivable to us that this single option proposed by one consortium, should even be considered on an all or nothing basis without a thorough evaluation of all the options, and all the possible

benefits and costs both economic and social.

The proposed Mackenzie Valley Pipeline, as we have said, is no ordinary development proposal. Any project of such gigantic magnitude, built over such a short period of time is bound to involve some special problems which require an unusual degree of public participation in the decision making process. We would like to comment briefly on the nature of these special problems.

1. The proposed development would be of such hugh proportions, and carried out in such a short period of time, that there would be unavoidable disruptions in these industries which will be called upon to produce the steel, the pipe, the machinery and other matderials necessary. The industrial structure would be distorted as these industries attempted to meet the short-term demand and in the process, other socially necessary projects would be compromised. In addition, since the Canadian steel industry is not capable of producing the required volume of large diameter pipe in the short period of time involved, Canadian content in this project would be much smaller than would be the case with some alternative projects.

Employment generated in the construction phase of the development would be short term, would primarily involve specialized labour displaced from other projects in the South. The boom created in the construction industry would be matched by a slump when the project was completed.

We believe that a smaller

scale pipeline, built over a longer period of time would reduce the structural disruption in Canadian industry and increase Canadian content.

2. Serious economic problems on a national scale will result from the construction of such a large project, financed primarily with funds from foreign sources. Some economists believe that the capital inflows will be large enough to increase the exchange rate dramtically. There is no doubt that the excessive demand for industrial goods will increase the rate of inflation. The project will also involve an extension of foreign control in the Canadian economy. Furthermore, it is likely that increased export of Canadian natural gas would be involved, at a time when Canada's long term energy needs have not been clearly established.

We believe that a pipeline built to serve Canadian markets and financed primarily with funds under Canadian control would be more appropriate for the Canadian economy and more in keeping with Canada's long-term energy needs.

3. The environmental impact of the proposed development has been studied, but the result is still unclear. Obviously there would be substantial environmental damage, however, and this would represent a heavy sociai cost to be born by the residents of the Territories and the native people especially. Furthermore, the damage will occur in areas which are claimed by the native people, and these claims have not yet been settled. Representatives of the native people's associations have already testified

before this Commission that the construction of a pipeline during the negotiation of these claims would prejudice their case.

Whether or not a pipeline is compatible with the land-based economy of the Mackenzie Valley inhabitants can only be decided by the natives themselves, once their rights to the land have been established.

To make any decision about a pipeline while these land claims are still undecided, would be grossly unjust.

We believe that no pipeline rights should be granted until the environmental impact has been thoroughly assessed and the means of mitigating that impact have been decided upon; and until native land claims have been equitably settled.

We will not attempt to second guess the experts by providing answers to all these questions. We raise them now, not because we have ready solutions, but because we believe that they represent social costs which do not even enter into the calculations of the private interests who are proposing to build this pipeline, must less receive the consideration that the public interest requires.

Our union, involved as it is with natural resource extraction all over Canada, is familiar with this basic conflict of interest. The fundamental problem is that the benefits of this type of development, accure to corportions in the form of higher than normal profit levels, while many of the costs accrue to other

groups in society. The reason for this is that social costs are not "priced" by the market and hence do not enter into the cost-benefit calculations of those who are interested in purely private benefits and costs.

The Canadian public interests as well as the interests of the people of the Northwest Territories, cannot properly be met by the granting of any pipeline rights at this time. The public interest demands that a comprehensive evaluation be performed with reference to all the possible options and with reference to all the economic and social costs and benefits, whether private or public. A wide range of options, ranging from no development to non pipeline alternatives, such as a railroad, need to be considered.

"The railway alternative in particular appears to have been dismissed out of hand because of its alleged inefficiency for transporting natural gas and also because of the environmental damage which it might cause. But we do not believe this option has been adequately studied from the standpoint of over-all long term economic development in the north. The fact that no one at this point is proposing to build anything other than a pipeline does not lessen the need for a comprehensive study of all of the options.

"This can only be done with reference to a national energy policy. The use of Mackenzie Valley Gas in particular, or even fossil fuels in general cannot be analysed in isolation. Energy development must be an integrated process, encompassing the study of sources, transportation, the uses of all forms of energy. It cannot be taken for granted that the exploitation of fossil fuels in the Arctic is neces-sary or desirable, simply because one group of companies thinks it can make a profit from a pipeline. Certainly it would be bad economics if over-development of natural gas supplies were to lead to an even greater reliance on this depletable resource, when Canada should be looking to the development of alternative sources of energy and allocating capital accordingly. Furthermore, the social implications are so immense that it is clear that a project of this magnitude can only be properly undertaken under public control.

The Canadian public must not be allowed to be blackmailed by the threat of an

alleged "energy crisis" into believing that the pipeline as proposed is an all-or-nothing propositon. The question is not whether MacKenzie Delta natural gas should be utilized or not, but rather at what time and in what form such development should take place, and under whose control the completed utility should be.

"We are aware that some of the problems we have raised do not fall within the terms of reference of this Commission. Nevertheless, we believe that the COmmission, if it finds that essential national policies have not been formulated in areas which are crucial to this inquiry, should make it clear that any decisions made at this time are premature.

All of which is respectfully submitted, on behalf of the United Steelworkers of America and the Locals in this area.

THE COMMISSIONER: Thank you very much, sir.

You said that you were prepared to document this brief, by that I take it, to supply some of the facts and figures that the union and its staff worked up in preparing this, is that what you meant?

WITNESS STEVENS: Yes, Mr. Commissioner. It's too bad we didn't know the way this was going to proceed, but we do know the volume of production that our steel mills and our pipe mills can produce in Canada, and we also are aware of the volumes which the steel mills and pipe mills can produce in the United States of America. From this knowledge of

our own units, we are prepared to document the evidence at the mills and the pipe mills and rolling mills in Canada and the United States, will not be in a position to supply the necessary pipe that is needed for this kind of a pipe mill at this time.

Mr. Walldie, who is from our National REsearch Department, has put a considerable amount of work on it. As I say, I'm sorry, we did not bring other evidence down today.

THE COMMISSIONER: Well, we may at some stage ask that Mr. Walldie return if -- we will leave that with Mr. Scott who is commission counsel to consider, but we might ask Mr. Walldie to come back at some later time. You are Mr. Walldie, aren't you? Well we might ask you to come back at some later time and -- to bring some of the material with you that was spoken about.

Would anyone else on the panel care to add anything? Mr. Cook?

MR. COOK: Maybe you would care to hear from some of the local residents at this time?

THE COM MISSIONER: Certainly. If any of you who are on the panel would like to add anything, feel free.

WITNESS STEVENS: Bob Garlick, who is the president of the Steelworkers' Northwest Territories Area Council from way of Pine Point.

MR. GARLICK: I have nothing more to add, other than to reiterate the outline in

regards to the social implications and the need for the study of the environmental ramifications. We also feel that it's not really necessary at this time to exploit this gas without further consideration to our nation's needs, and long-term needs. That's particularly about all that I have to say at this moment.

THE COMMISSIONER: Thank you, Mr. Garlick.

MR. GARLICK: Other than again to reiterate that the native land claims must be settled before anything in this line can proceed.

MR. COOK: I think, Mr. Chairman -- my name is Cook. I might say to you that those of us who have been engaged in representing Steelworkers, the steel industry as we have for a good many years, are worried that we would have -- if the industry was able to create a demand, and thereby a development of the industry in a direction meeting the demands of this project in the period of time that is outlined, we would have a very imbalanced steel industry, in our view, develop as a result of that.

Certainly, the capacity of the pipe mills in Canada and the capacity of the plate mills to build the material --

THE COMMISSIONER: What mills?

MR. COOK: Plate mills.

THE COMMISSIONER: Plate mills.

MR. COOK: -- aren't sufficient to develop anything like the quantities of large steel

pipe that are required here, very small proportions in the Canadian mills, and to suggest that --

THE COMMISSIONER: Sorry, in very small proportions -- you might pull the microphone a little closer to you.

MR. COOK: A very small proportion in the Canadian mills could be produced, the capacity of those mills in large size pipe is very limited, and projects like the Lake Erie development, which will bring on stream larger amounts of plate steel --

THE COMMISSIONER: Now the Lake Erie development, is that the new plant at Welland?

MR. COOK: No, that's the Steel Company of Canada's plate mill development on Lake Erie --

THE COMMISSIONER: I see.

MR. COOK: -- which is not going to come on stream for a couple of years, and which will be a major supplier of the material to the Welland mill. She's not there as yet for the production of steel, and in the time frame that we have heard discussed with respect of this project, would only be there for the finishing parts of the project, rather than for a major supply of it. In any event, even when that's on stream, it would still be a very small part of the total amount of large size pipe that could be made in this country.

The miles and miles of pipe that we are talking about here would tax the whole

world's capacities in large size pipe, which is not an easy thing to overcome. Now, there are demands on the world supply of large size pipe in addition to this project, so that it's very questionable, in our view, and certainly I think the -- any applicant for licences to proceed with this kind of project should be able to establish that this is available without totally distorting the steel industry, because we do have other needs, and we do need to have a development of that industry, in our view, that meets the general growth needs of Canada, and not be distorted totally in one direction, and to upset the basic steel economy in the country, and further than Canada's boundaries obviously, because you would be dealing with capacity from large areas of the world in order to touch this size of production in the time frame that has been suggested.

Smaller dimension pipe, of course the capacity is larger. A longer time frame, of course, the needs can be met with less stress. I would think that it would be incumbent upon those making a project submission to really demonstrate the ability of the market to produce without distorting it all. I think that would be the added comment that I would like to make at this time.

THE COMMISSIONER: Thank you Mr. Cook. Anything you'd like to add?

MR. STEVENS: That seems to be our submission, Mr. Commissioner.

THE COMMISSIONER: Well, thank you very much. It may interest you that last week we held a community hearing in Fort Simpson and the Chamber of Commerce there made very forcefully one of the points you have made. That is, they urged the construction period be stretched out. so that the impact on the Northern economy would be less in each year than it would be if it were constructed with the present schedule proposed.

All of these points are very interesting and we will take them into account, we have already looked at some of them, but we will be looking at some of them in greater detail and when we do, we may well ask Mr. Walldie to come back, but you will be given plenty of notice of that. If you are brought back, Mr. Walldie, the lawyers for Arctic Gas at least, will probably want to ask you some questions, and you'll have to be ready for that.

MR. STEVENS: That will be their day in court, will it?

THE COMMISSIONER: I don't know whether the lawyers from Foothills will want to ask you anything, but we shall see.

MR. COOK: I think that's one thing we might request, Mr. Chairman, and that is, a schedule of your hearings when you're coming down East. It may be that our national office would like to make a further submission, or our district office at that time.

THE COMMISSIONER: You'll be hearing from Mr. Waddell, you'll get plenty of notice of that.

So thank you very much, and we do appreciate your coming and if you wish to remain, you are certainly welcome to stay and to listen to what is going on here. We will be adjourning in an hour or so for coffee and if you're still here then you're welcome to join us for coffee.

MR. STEVENS: Thank you very much.

(WITNESS ASIDE)

MR.GIBBS: Before I call my next panel sir, I have some material to file, that we undertook to provide during the last time we were in Yellowknife.

The first are copies of a slide which was referred to by Mr. Blair, showing the spare capacity which will exist in the Alberta Gas Trunk Line System, Exhibit Number 221 was reserved for that

photograph and we're ready to file it now.

(SLIDE SHOWING SPARE CAPACITY OF ALBERTA GAS TRUNK LINE SYSTEM MARKED EXHIBIT 221)

MR. GIBBS: Then sir, a transcript reference, pages 8279 to 8283, Mr. Scott asked Mr. Blair for some detail on the capital costs and the proportions of public financing, for the Foothills project and we are ready to file that detail now, What would be the next exhibit number please.

That becomes Exhibit 225 sir.

(INFORMATION RE CAPITAL COSTS MARKED EXHIBIT 225)

MR. GIBBS: A transcript reference, pages 8290 to 8292, there was a request about detail on the cost of gas to Northern communities, I believe by Mr. Scott.

THE COMMISSIONER:. Yes.

MR. GIBBS: We're ready to file that sir as Exhibit Number 226.

(DETAIL ON COSTS OF GAS TO NORTHERN COMMUNITIES MARKED EXHIBIT 226)

MR. GIBBS: Then sir, at page 8388 the witness Gillespie was describing from some charts he had, river crossings. I undertook to have those photographed in smaller sizes and marked as an exhibit. I have them, I don't have extra copies, but I think there are two here and if anyone who wants to see them could see them through Miss Hutchinson.

That's Exhibit 227.

(CHARTS OF RIVER CROSSINGS MARKED EXHIBIT 227)

MR. GIBBS: Then sir, at transcript page 8395, Mr. Marshall asked the witness about Travailant Lake and the Thunder River Denning areas and we have -- he wanted the references used there and we have that material to be filed sir, as Exhibit 228.

(TRAVAILLANT LAKE, THUNDER RIVER DENNING AREAS MARKED AS EXHIBIT 228)

MR. GIBBS: At page 8492, Mr. Scott asked the witness Fawcett about the selection of the corridor and the composite maps that were made up. We have, in response to that request, a memorandum sir, and some maps to demonstrate what was done in that connection. This will be Exhibit 229.

(MEMORANDUM AND MAPS MARKED EXHIBIT 229)

THE GIBBS: The maps sir which are quite large, perhaps might be left in this container and marked as Exhibit 230, I'm sure my friend's advisors will want to examine them.

(MAPS MARKED EXHIBIT 230)

MR. Marshall Excuse me, Mr. Gibbs, what did the large maps pertain to? Were they part of the material Mr. Fawcett was producing?

MR. GIBBS: Yes.

MR. Marshall I see.

MR. GIBBS: They show the original corridor and then on blueprint maps show the actual route within the corridor that was originally examined.

Then sir, at page 8501, a request was made for the Klohn Leonoff Reports on route

adjustment, and we're ready to mark those reports as Exhibit 231, as well as the original report this exhibit contains weekly reports as further examinations were done.

(REPORTS ON ROUTE ADJUSTMENT MARKED EXHIBIT 231)

THE COMMISSIONER: Thank you.

MR. GIBBS: Then sir, the next request we filled occurs at page 8514, and that was a request for a list of the environmental reports and studies relied upon by the Environmental consultants and that we could mark now sir as Exhibit 232.

(ENVIRONMENTAL REPORTS AND STUDIES MARKED EXHIBIT 232)

I should point out, in connection with Exhibit 232, sir, that by no means all of those reports are within the Foothills' Pipelines possession. Some of them are in the library of their consultants.

Then, sir at pages 8510 to 8523 inclusive, requests were made to have detail of route adjustments recommended by Lombard North, which is a consultant to Foothills' Pipeline Limited, and we are ready to mark that now, sir, as Exhibit 233. This exhibit shows on the first page, route changes recommended and adopted and on subsequent pages, route changes which have been recommended by Lombard North but have not yet received final decision by Foothills.

(ROUTE ADJUSTMENTS RECOMMENDED BY LOMBARD NORTH MARKED AS EXHIBIT 233)

MR. GIBBS: Again, sir, before going on with the evidence, there are two other points I would like to raise with you, and those both arise from the cross-examination of the panel on location by Mr. Scott; during the course of which he asked certain questions which left inferences which I'm sure he would not like to be left because they were wrong, and the inferences arose in part from the wording of his questions. We want to make sure that those inferences are corrected and I would like to do that at this time, sir.

The first place where that occurred was at page 8547, and at that page, sir, Mr. Scott, in cross-examining the location panel said,

"Do you know the location of the site of Fort Alexander with relation to this line?" "A No, sir, I don't." Have you ever heard anything about how the line runs now in relation to Fort Alexander?" "No." "Have you ever heard of Fort Alexander?" "Yes." "Do you know where it is?" "No." Then you, sir, confess that you haven't heard of it either.

Mr. Scott goes on and says,

"Well it is located as I understand it on the north bank of the Willowlake between the highway and the pipeline", and you sir say, "Between the highway, between the line on the map." Mr. Scott: "Between the line on the map which will be the highway, perhaps, and the pipeline". "THE COMMISSIONER: Perhaps." "MR. SCOTT: Perhaps".

"What is the scale of this map, Mr. Gillespie?

WITNESS GILLESPIE: This map is approximately one inch equals 2,500 feet.

"So I take it at the point where the pipeline crosses the Willowlake it is approximately 2,000 feet from the proposed highway?

"A Yes.

"Q Yes,and Mr. Bouchkout, did you ever hear that Fort Alexander was precisely at that junction?

"WITNESS BOUCHKOUT: I have never heard that, sir, however, our archaeological consultants will certainly be looking into that once we have defined the route in terms, of from the environmental

point of view in terms of putting the additional archaeological information into it.

Q "Well, I take it that whatever you may do in the future, there has been no environmental assessment that relates to that juxtaposition of the highway, the line and this particular site, Fort Alexander?

"A Our archaeological consultants have looked at this line and they have indicated I believe to date that there are no immediate changes to be made from an archaelogical point of view.

"Q They have expressed no concern?

"A Not to my knowledge to me specifically, sir.

"Q Yes, do you know anything about the location of historical grave sites on that particular portion of the route?

"A Personally, no, I do not.

"Q Have you ever heard anything from your archaelogists or anybody else about the impact of the pipeline and the proposed highway on those grave sites?

"A Not personally.

"Q Have you heard any complaints about the location of the line with regard to that?

"A Not personally."

Now sir, that was some concern to us, the thought or the implication that those grave sites had been ignored and so further investigation has been done and I am informed as follows: Inquiries were made by Paul Whitney, Biologist for the Lombard North group as to the location of grave sites in the vicinity of Willowlake River and where were those sites in relation to the proposed Foothills' Pipeline route location. He was told of two grave locations; one located a mile downstream on the Mackenzie River and one west of the proposed Mackenzie Highway. Foothills' line is east of the Mackenzie Highway by about a quarter mile and would not conflict with this grave location.

It has come to our attention that the Department of Public Works had to alter the location of the highway approximately 100 feet east, to avoid a grave site area. As previously mentioned, our location approximately one-quarter mile east of the Mackenzie Highway should avoid this site.

Now sir, I take it that that satisfies my friend that we are not in any sufficient proximity to do harm to the grave sites.

The second one, sir and --

MR. SCOTT: Perhaps I should be allowed to deal with that. Mr. Gibbs wasn't here and perhaps the impact of what we were attempting to elicit isn't clear from the transcript. We didn't assert that -- and I don't know whether it's true, we didn't assert that their proposed route ran over a grave site or ran through the entrance of Fort Alexander. We were

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simply concerned in assessing the input they had when they selected their route, and we asked therefore, if they were aware of the existence of these phenomena, not to determine whether they rode over them, but simply in terms of making their decision as to whether the route -- as to where the route should go.

If my friend is now telling me that they are not going to run over a grave site, I of course accept that.

MR. GIBBS: Well I took that the questions sir, in the transcript, meant what it said, when he said that Fort Alexander was precisely at the junction of the pipeline crossing Willowlake I thought that should be corrected.

The second one, sir, I view somewhat more seriously and that has to do with the International Biological Program sites. At page 8583, my friend, in cross-examining the same panel starts this series of questions:

"Q Did you know that in drawing your line to Yellowknife and Pine Point you crossed through three International Biological Program areas?

"A I believe that Mr. Bouckhout is aware of one of them at least.

"Q Well, are you going to -- you make a fuss about something that you did at the Ebbutt Hills, and on this lateral at Yellowknife you pass through three International Biological Program areas, one of which is leased to the University of

Alberta for a particular project."

Now sir, that is incorrect. We have done subsequent investigations on this because again we were concerned, and the instructions I have, which are backed up by correspondence we have here that my friend can examine if he wishes, are as follows: That the location of the proposed Yellowknife-Pine Point service lateral will not establish any conflict with International Biological Program site 22, which is the Deep Bay WOod Bison Sanctuary; 49A which is the Mills Lake Sanctuary; 49B, Horn River. It does fall on site 79, Hart Lake and the witness made his explanations about that.

Now, sir, I'm sure my friend did not do this intentionally. There are a number of these maps apparently issued periodically, and as I say we do have the correspondence which we engaged in after our last appearance here to make sure that we were not, as he said in his question, crossing three International Biological Program areas.

MR. SCOTT: Well, Mr. Commissioner, a number of points with respect to that. Land use maps are issued which show these sites, and the purpose of the question was to invite the witness to comment on whether, in drawing the route or the lateral, he had consulted the maps. If he had consulted the maps, he would have seen the Biological sites that were listed. That's point one.

Now, I can see that it may be that new maps are issued which amend the location of the

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biological sites. If the witness was relying on those, he no doubt would have told us. If there are new land use maps which alter the position of those sites, I will make an inquiry to determine whether that's true, and let you know. Certainly, my instructions are that on the latest maps of which we have knowledge, it passes through three sites.

Now, my friend says that there is -- he has information that the location of the line is not in conflict with those sites. That's an entirely different question, of course, and we'll just have to deal with that at some other stage of the inquiry. I will, however, attempt to find out whether there are more recent land use maps which make my question less pointed and if there are, I'll bring them to the inquiry's attention. I would be grateful if my friend can produce them, if there are such.

MR. GIBBS: Those were the points I wanted to bring up and particularly the one where, in my submission, it is not a question, it is an assertion that we crossed / through three sites and we took issue with that assertion sir.

Now, Mr. Commissioner, we are ready to proceed, with our fourth panel of Foothills Evidence. I should explain sir, this is Panel 4, although it is the third to appear but because Panel 2 was not heard. Could we have then, Mr. Mirosh, Mr. Lazerte and Mr. Hensche to the stand please.

E.A. MIROSH: Sworn

RONALD M. LAZERTE: Sworn

D. HENSCH: Sworn

MR. GIBBS: In reproducing this prepared evidence sir, the Mag Card system didn't work entirely accurately, so the beginning and the end, there will be some slight deviations to insert what should have been there in the beginning.

DIRECT EXAMINATION BY MR. GIBBS:

Q Mr. Mirosh, you are Manager of Engineering for Foothills Pipelines?

MR. MIROSH:

A Yes.

Q In that capacity you appeared before this inquiry previously?

A Yes, I appeared as a member of the locations panel on August 20 and 21.

Q Mr. Mirosh, can you explain the basic differences in the hydraulics philosophy between

Canadian Arctic Gas and Foothills application?

A The most significant difference between the two proposals is that Canadian Arctic Gas is planning to bring gas from Alaska to connect with its main line. In doing so, CAGSL have sized their mainline to 48 inches and also their Alaskan and Mackenzie Beaufort connections are sized at 48 inches, with alternatives offered to decrease these to 42 inches.

In the Foothills hydraulic design, we do not propose to bring gas from Alaska to connect with the mainline. In addition, our main pipeline from the Richards Island Gas Plant to the 60th parallel is sized at 42 inches.

The second major difference is the operating pressure level and the resulting wall thickness of the pipe.

C.A.G.S.L. is proposing to operate at 1680 P.S.I.G. with a resulting 48 inch diameter pipe wall thickness of .720 inches. In the case of Foothills we are proposing to install and test a 1440 P.S.I.G. system with a pipe wall thickness of .540 inches.

Foothills proposes however, to operate this system at 1250 P.S.I.G.

A third difference to be noted is that Canadian Arctic Gas proposes to chill the gas to their station M-17 and from this station to Zama Lake, they operate with a freeze / thaw cycle. In contrast, Foothills would cease chilling and ensure that

gas temperatures remain above 32 degrees farenheit south of Fort Simpson.

The fourth major difference concerns volumes and build up period. In the Foothills case, we propose to begin operations with a volume of 800 million cubic feet per day building up to 2.4 billion cubic feet per day, over a period of five years. All of this gas would come from Canadian gas plants in the Mackenzie Beaufort area. Canadian Arctic Gas on the other hand, assumes that 1.25 BCF per day would be available from the Mackenzie Beaufort area for its first year of operation. For its second year of operation, C.A.G.P.L. assumes 2 BCF per day, being made available from Alaska as well. Following the second year of operation, when approximately 3,25 BCF per day in total is being received, the C.A.G.P.L. builds up to the maximum of 4.5 BCF per day, over the remaining three years, resulting in an ultimate receipt volume from Prudhoe Bay and the Mackenzie Beaufort area of 2.25 BCF per day from each area.

The fifth difference is that our design assumes the use of primarily 24,000 horsepower gas turbine driven compressors, whereas C.A.G P.L. proposes using 30,000 horsepower units.

Q You have mentioned that the Foothills ultimate volume will be 2.4 cubic feet per day. Can you explain that a little further?

A When we begain our first hydraulic studies for Foothills, we chose to use 2.25 billion cubic feet per day, from the Mackenzie Beaufort

area since this was the volume used by the study group. Using this volume, we carried out some preliminary hydraulics designs for different arrangements of pipe and compression.

Subsequently, Mr. Mackie, our Manager of Evaluations and Forecasts, together with his consultants, carried out intensive studies concerning probable reserves additions in the Mackenzie Beaufort area and market projections for Canadian gas needs in Canada. Based on this work, we were advised by Mr. Mackie that in the near term, 2.4 billion cubic feet per day would likely be required by Canadian markets. and in addition, that this volume could comfortably be supplied with the projected reserves additions from the Mackenzie Beaufort Basin.

I should point out that the 2.4 billion cubic feet per day we refer to, is a receipt volume at the top end of the pipeline which represents 95 percent of the pipeline system capability.

Using an average day volume of 2.4 billion cubic feet per day, our engineers carried out studies for several different pipeline diameters, operating pressures and compressor unit sizes. The results of these studies which were shown in our application in graphical form, in Section 3B-1.0 indicate the relationships between volumes and cost of service for the different pipeline configurations.

These studies indicated to us that a 42 inch pipeline system, with a .540 wall thickness operating at 1250 pounds per square inch and with 24.000

ISO horsepower gas compression units, could carry an average day receipt volume of approximately 2.4 billion cubic feet per day, at a minimum cost of service for that particular configuration if the stations were optimumly spaced. The study showed an optimum spacing to be, on the average, around 48 to 50 miles between compressor stations, for a total of seventeen stations.

These comparative cost of service calculations were carried out using all pipe and compression costs for both installation and operations and maintenance. However, the costs for support facilities for construction were not included and the effect of adding all costs into the comparative studies would be to shift the optimal volume for all pipeline configurations to slightly higher levels of throughput. For comparative purposes, therefore, it is not necessary to include the costs of common facilities which would be required for any of the pipeline configuration studies.

In summary, we have chosen 2.4 billion cubic feet per day, since this is the volume which has been determined by both the study of Canadian gas requirements and by projected reserves addition study for the Mackenzie Beaufort Basin. As well, we have determined from our hydraulics work, that 2.4 billion cubic feet per day can be carried by a pipeline system such as the one we propose, at a minimum cost of service for that configuration.

Q Will you explain why you have chosen to operate your system at 1250 pounds per square inch gauge rather than 1440?

A A metallurgical panel which will shortly appear before this inquiry will deal with the subject of unstable ductile crack propagation. which was the principal reason for reducing the operating pressure from the design pressure. In reducing the operating pressure, as we have done, we have reduced the operating stress levels which the pipe will be subjected to due to internal pressure. By specifying pipe with the highest currently achievable toughness properties and by examining various combinations of pressures and temperatures which this pipe will be subjected to during operation, our metallurgical engineers have determined that a reduction of pipe stress levels consistent with reducing the operating pressure from 1440 PSI to 1250 PSI will limit propogating ductile cracks, should they ever occur.

For our hydraulics studies, therefore, we have taken the maximum operating pressure to be 1250 pounds per square inch. Our station spacing was based on using this maximum operating pressure. We also ran studies to see what differences would occur in our station spacing had we chosen to use a 1440 PSI maximum operating pressure. A comparision of the cost of service results is shown in our application and as may be expected, operation at the higher pressure allows the pipeline system to carry a higher volume at a lower cost of service.

Q Will you now explain how the Foothills system connects with other pipeline systems and processing plants?

A The Foothills Pipe Line system would receive and meter gas from the downstream side of the gas processing plants at the north end of the pipeline. The pipeline runs for approximately 817 miles to a point located about 6 miles north of the 60th parallel where compressor station 17 would be located and where two meter stations would be installed.

One of these metering stations would meter gas into the Westcoast Transmission system over a connecting link through the Northwest Territories and British Columbia, to a point near Fort Nelson. The second metering facility located along side of the first, would meter gas which moves into the AGTL Canada system through the Northwest Territories and Alberta via a connecting link to a point of intersection with the Alberta Gas Trunk Line system near Zama Lake. At station 17, gas discharge temperatures will be limited to 80 degrees/ fahrenheit by an aerial cooler and pressures and volumes will be regulated so that both receiving pipeline systems would obtain the agreed upon quantities of gas at pressure levels consistent with their existing operating systems.

Q Mr. Lazerte, you are the Supervisor of Station Design at Foothills Pipelines?

MR. LAZERTE:

A Yes.

Q Does the sheet attached to the prepared evidence and having your name at the top accurately describe your academic qualifications and experience?

A Yes.

Q Would you read the contents in please?

A Education, BSC in Chemical Engineering, 1946, University of Alberta.
Experience, employed in the oil and gas industry since 1947. British American Oil Company Limited, 1947 to 1953, plant engineer, Longview Gas Plant. Engineer on construction of the Edmonton Refinery. Operations engineer, Edmonton Refinery. Startup and operations engineer, Moose Jaw Refinery expansion. Texaco Exploration Canada Limited, that's a wholly owned affiliate of Tex Inc. 1953 to 1974, project engineer on the design of the Bonny Glen Gas Plant. Plant Engineer, Bonny Glen. Gas Engineer, Calgary. Staff gas engineer, Calgary. Senior Engineer, Calgary. Superintendent, Gas operations, Calgary. Assistant Superintendent, Gas, Calgary. I joined Foothills, November, 1974.

Q Mr. Lazerte, will you explain why at compressor station one on the Foothills' Pipline you have allowed excess compression horsepower to exist at capacity flow?

A Station 1, sighted 46 miles south of Taglu and five miles north of the Parsons Lake junction is scheduled for start-up in the fall of 1982, year four. With all 17 stations installed and the pipeline operating at its maximum capacity or capability, the first station pulls approximately 12,000 or half of its rated horsepower of 24,000. In other words, it is very lightly loaded.

We took this approach as this station is closest to the major supply of gas, the Taglu gas plant, and we wanted insurance against possible outage of the plant booster compressor. This plant supplies about 80 percent of the total gas in the pipeline. The main treating portion of the plant operates at a pressure of 1080 Psia and following processing for water and liquid hydrocarbon removal from the gas, it is compressed and cooled for entry into the pipeline.

The final compression of the gas from 1080 pounds per square inch to the higher pipeline pressure will probably be accomplished using a gas turbine driven centrifugal compressor of the same general type as proposed for use by Foothills.

Though very dependable, this machine will unavoidably suffer some down time during

a given year, and for these few hours or days the Producer plant delivery pressure will be reduced to 1080 PSIA. Under these plant compressor outage conditions, we can maintain the design delivery volume from Taglu of 1900 million cubic feet per day with Station 1 equipment fully loaded and developing the rated horsepower of 23,550.

With the above plant outage conditions, if station 1 installed horsepower was only 15,000 to meet normal requirements, the reduction in receipt volume would be much more severe than we will experience. Also, if Station 1 was located further south with the 24,000 horsepower unit, the volume reduction would be more severe as less surplus horsepower would be available during a plant compressor outage.

In summary, installing surplus horsepower at station 1 allows more gas to be transported in the event of a low delivery pressure condition at the Taglu Plant.

Q Will you explain what criteria you used in determining the receipt conditions for gas at the processing plants?

A Initially the receipt pressure for the Producer gas plant sales gas will be 1250 PSIG which corresponds to the maximum operating pressure of the pipe. Of course, there is a possibility our system may ultimately operate at 1440 PSIG so that the Producer plant compression equipment should have this higher discharge pressure capability in the event we find at some later date that we can operate at the

higher pressure.

We plan on receiving gas from the plants at a temperature of 25 degrees Fahrenheit to be consistent with our operating philosophy of a chilled line, that is below freezing temperature down to Fort Simpson, to prevent degradation of the perma-frost. This receipt temperature of 25 degrees Fahren-heit will ensure arrival at the suction of the first operating downstream compressor station below 32 degrees Fahrenheit under all conditions.

With regard to the gas quality specifications, these are fairly standard to a point. That is, the delivered gas will not contain: (1) solids, liquids or objectionable substances which would cause problems, (2) more than one grain of hydrogen sulphide or ten grains of total suphur per hundred cubic feet and (3) more than two percent carbon dioxide without our permission. Also, it should be free of oxygen and in no event should it contain more than four tenths of one percent.

Foothills will have two require-ments that are not standard for normal gas transmission lines. Firstly, the water vapour content should not ex-ceed 0.4 pounds per million standard cubic feet which corresponds to a water dewpoint of minus 5 degrees Fah-renheit at 1250 PSIG. This specification is more rigorous than normal due to our higher operating press-ure and lower operating temperature. Both these variables favour the formation of solids or hydrates in the pipeline which could interfere with the passage of

gas so this condition should not be allowed to develop. In order for solids or hydrates to form, free water in liquid form must be present. We ensure, therefore, this doesn't occur by having the Producers remove most of it from the delivered gas. By setting the above specification, no water droplets can form until the pressure increases to 1440 PSIG and the temperature drops to minus 3 degrees Fahrenheit. This will not happen in our pipeline because even if we do operate eventually at 1440 PSIG, we will not allow the temperature to drop lower than 10 degrees Fahrenheit under normal conditions.

Secondly, we have specified a series of hydrocarbon dewpoints which limit the quantity of heavy hydrocarbon constituents the Producers can pass into the line. This is done by specifying a number of pressures and temperatures at which the first drop of hydrocarbon liquid will form in the line and setting these at such a level that they will not occur under normal operating conditions at any point in the pipeline system. Condensation of hydrocarbon liquids in the line is to be avoided as they increase thepressure drop, increase horsepower and fuel requirements, and, if present in sufficient quantities, can damage compressor blading and flood inlet separators.

Q Will you explain the volume build up which Foothills is using and how this build up was arrived at?

A The volume build up is obviously firmly tied in with the estimate of total reserves, deliverability, rates of discovery and market

considerations. The build up was developed by Mr. Mackie and he provided these volumes to me. What I would like to discuss now is the engineering aspects related to the rate of build up. I believe we have a slide. Foothills shows a volume build up, by years and field, as per slide 1.

MR. GIBBS: Would you just hang on a second, Mr. Lazerte?

WITNESS LAZERTE: Gladly. I don't need to deal with this in too much detail. We show the Parsons Lake delivery volumes --

Q That's the right hand --

WITNESS LAZERTE: On the right hand side of the slide. We show Taglu in the middle, and we show the total delivery on the left hand side. Now, please note that these are receipt volumes, as Mr. Mirosh commented, receipt volumes into the pipeline at the northern end.

Now, you will notice lastly the capability figures in the text, there was an error, the 2,500 of course should be 25 -- that's still done wrong -- my apologies, it should be 2550, so we've managed to make an error there.

MR. GIBBS: Compound the error?

WITNESS LAZERTE: I'm afraid so.

Q THat capability line on the bottom then, just to make certain,

the first number should be 2,550?

A Yes.

Q And the next one 2050 is correct, as is the last one, 500?

A Yes, the number on the left is the incorrect one.

You will note that we have assumed all of the first year gas to be produced from Taglu since our information indicated that planning and development of this field, plant and related facilities, was somewhat ahead of the Parsons development. We further assumed that 10 percent of the Taglu stream originated from the Niglintgak field.

The volume build up shown on the slide coincides with the compressor station schedule shown on Slide 2.

Now again, there has been a slight omission from this slide and you will notice when I read from the text what it is. You will note that to flow the first year volume of 800 million a day, we require that two full stations and four partial stations be --

THE COMMISSIONER: Excuse me, Mr. Lazerte. Mr. Gibbs, you gave me copies of these slides. Should these be marked as exhibits as the witness refers to each slide?

MR. GIBBS: I had proposed to, sir. We can mark the first one now, or both of them if you wish.

THE COMMISSIONER: I think you

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might mark the one called volume build-up as the next exhibit.

(SLIDE MARKED VOLUME BUILD UP MARKED AS EXHIBIT NUMBER 234)

MR. GIBBS:

Q Mr. Lazerte, perhaps in explaining this, you might be able to do it better by standing and pointing to the slide itself, if that's more convenient?

A Yes, I agree.

Just reading from the text before I do, I will just read that first sentence again. You will note that to flow the first year volume of 800 million a day, we require that two full stations and four partial stations be operational in November, 1979.

If I may start, the original slide shows a reference to this November, 1979 start-up of two full stations and four partial. That information was then printed down in here and and we lost it somewhere along the route, so this is the start-up date referred to on the first one, and just very briefly, if I may go through this. This is a construction schedule and that shows the timing and I don't think we need to go through every year. fabricating transport materials to staging areas, this is the key on this schedule. Of course to try to meet this November 1979 date so transporting here -

and then you notice the other construction activities and they just flow on down, coming into November, 1979 and that's what we are aiming to meet.

MR. GIBBS: Perhaps we could now mark that one, sir, as Exhibit 235?

(SLIDE RE COMPRESSOR STATION SCHEDULE MARKED EXHIBIT 235)

MR. GIBBS:

Q Would you carry on now, Mr. Lazerte?

A By a partial station I mean that only the pipeline booster package is missing and all other equipment is installed and the station has chilling capability. The first year requirement for major rotating equipment is shown on slide 3.

Now, we are getting into some specifics here. You will note that there are two full stations here, station 7 is a full station; it has a gas turbine driver and compressor, 24,000 horsepower. The chilling capability is there matching it, 15,000. You will note at station 15, gas horsepower 30,000. We stopped chilling at 14, so that is a full station. There is no chilling to go in there, so 7 and 15 are full, then please note 5, 9, 11 and 13 had everything installed but the gas compressor. So those are the four partial stations referred to in the text.

MR. GIBBS: Could the copies of

that slide be marked, sir, as Exhibit 236?

(SLIDE RE YEAR REQUIREMENT, GAS TURBINE COMPRESSOR UNITS MARKED AS EXHIBIT 236)

MR. LAZERTE:

A May I continue?

MR. GIBBS: Yes, please.

A This requirement for 7 units should be relatively easy for the gas turbine compressor industry to supply and meet delivery commitments. Note that orders for this equipment are scheduled to be issued in mid-1976, moved to the site in the river shipping season in 1977, and hooked up in the 1978-79 construction years, and that was what was portrayed on the earlier slide.

The second year flow of 1200 million a day requires the construction of Station 3, with one each of a gas and propane compressor and installation of a gas compressor at station 11 for a total of three units. This commitment should be relatively easy to meet without difficulty.

The third year flow of 1600 million a day dictates that we construct station 17, one 30,000 horsepower unit and install a gas compressor at stations 5, 9 and 13, for a total of four units.

THe remainder of the units are installed to be operational in the fourth year and a total of 16 units are required. This will require careful scheduling to ensure purchasing and construction commitments are met.

I'd like to make one quick comment, note, 16 units, not 16 stations.

Q What's the significance of that, Mr. Lazerte?

A I'm pointing our here simply, I'm dealing with the capabilities of the industry to manufacture these compressor units, and I stress that point.

Q Will you now explain why 24,000 Horse Power gas compression units were selected for the chilled section of the pipeline?

A The primary consideration is that the gas compression equipment selected must be commercially available. There is no point in giving serious consideration to equipment sizes that will not be available when orders are to be placed. Also it is important that the selected units be proven and not experimental. We want something that will start up smoothly and stay on the line, with an absolute minimum of modification or change. The reliability and mechanical availability must be high.

Secondly, compression equipment should be of a size which does not violate the temperature constraints imposed on the pipeline. By this, we mean that if the units are too large they will be spaced many miles apart, and with the flowing gas expanding in the line, if the pressure drops, there is a cooling effect which will result in subzero temperatures under certain conditions. This condition could exist if we had a chiller failure at a given station, and sub-cooled the gas at the

immediate upstream station to compensate for this outage. The end result would be to reduce the flowing volume to maintain minimum operating temperatures by reducing the expansion effect.

In our detailed horsepower optimization studies, we examined the following gas turbine sizes:

24,000 H.P.

26,400 H.P.

29,200 H.P.

37.000 H.P.

The larger units proved to be slightly more economical on a cost of service basis but the difference was minimal. The 37,000 and the 29,200 H.P. units were eliminated from further consideration in the chilled portion of the line north of Fort Simpson, due to the low gas temperature resulting from the outage conditions discussed above. Of the remaining, the 24,000 H.P. unit was found to be marginally the most economical in the chilled section of the line.

In summary, we selected 24,000 H.P. gas compressor units for the chilled portion of the line as they are commercially available, conform to temperature constraints and result in a low cost of service.

Q Mr. Hensch you are the Supervisor of Facilities Planning for the Alberta Gas Trunk Line Company Limited?

MR. HENSCH:
A Yes.

Q Does the sheet attached to the

prepared evidence, having your name at the top, accurately describe your academic qualifications and experience?

A Yes.

Q Will you read that in please.

A Education, BSC Mechanical Engineering, University of Alberta, Edmonton, 1968. Experience, Engineer with Montreal Engineering 1968, to 1970. Engineer with Alberta Gas Trunk Line 1970 to present. Professional affiliations, Association of Professional Engineers, Geologists and Geophysists of Alberta, Canadian Society of Mechanical Engineering.

Q Would you briefly explain the principles behind the hydraulics studies you carried out to determine the pipe system required?

A The stimulation of gas flow in pipelines is a well developed science and we have done nothing new. Through an application of simple principles of fluid dynamics in the form of mathematical equations, we are able to predict the pressure and temperature profile for any given pipeline system for any given flow. The equations used are·

The Energy Equation·

The first law of thermodynamics which is a relationship describing the conservation of energy.

The Continuity Equation:

A statement describing the conservation of mass.

The Momentum Equiation:

Newton's second law of conservation of momentum which states that the force is equal to the rate of change momentum.

A Study of Part 3, Section 3B-7 of the Foothills Application will show these equations to be in the form rather unfamiliar to the gas industry. To be able to calculate the temperature profile, it was necessary to avoid making the simplified assumption that the flow of temperature remains constant over the length of the pipeline. In addition, the kinetic energy term has been attained for completeness, thus necessitating use of the differential form of the equations.

The input data required to carry out the hydraulic studies are gas quality, temperature and pressure of receipt gas. gas supply and delivery points, ground temperature and thermal conductivity and pipeline route and its elevation profile. Mr. Lazerte has spoken to the gas quality and supply. The pipeline and elevation data was provided by Foothills Pipeline and the other input requirements has been obtained from Alberta Gas Trunk Line as a result of their membership in the study group.

Q Can you explain the relationship between your office hydraulics studies and the field location studies which have been undertaken by Foothills?

A The result of an office study is a design which has compressor stations ideally located to meet hydraulic requirements. The final system configuration however, is not struck until input has been obtained from both aerial photography analysis and field reconnaissance. Each site initially located by the office study is reviewed to ensure suitability of

terrain, site access, and reasonable distance from settlements. Should a site need to be changed, the new location is submitted to the office hydraulics studies to determine the impact of such a move on the proposed system's capability. Often the impact is one which may require a new design and possibly further site survey. As a result, striking a system design is not finalized until both the flow and the geographical constraints are met.

Q Can you show how your studies led you to conclude that a 42 inch pipeline is appropriate for the Foothills system?

A Various combinations of pipe diameters, working pressures and compressor station horsepower were analyzed before Foothills chose to present the 42 inch system as the one which would most economically provide the transportation service required. The analysis included consideration of 36 inch, 42 and 48 inch diameter pipe, working pressures of 911, 1250, 1440 and 1680 psig and horsepower blocks of 20,000, 24,000, 26,400, 30,000 and 35,000 H.P.

System designs were determined for a flow range of 1000 MMCFD to 3000 MMCFD in increments of 250 million. Capital costs for Operation and Maintenance and fuel costs were estimated for each of the designs and subsequently the cost of service for each was calculated. A plot of cost of service versus flow was then prepared.

We have two slides that will illustrate the method of comparing cost of service to the flow for each of the systems we studied.

Slide Number 1, illustrates a cost of service comparison of just three of the alternatives we've considered in determining the pipe system. The pipe system to put forward.

Q Could you go up and explain that slide to us now, Mr. Hensch?

A On this slide we've just chosen to demonstrate, our procedures, we select a 42 inch 48 inch, 1250 pound system, 42 inch 40 pound system, and a 36 inch 1680 pound system and at a constant horsepower of 24,000 H.P.

We prepared designs for each of these three in the flow range that I just earlier mentioned, 1000, 3000, and prepared cost estimates for each. The result of that cost estimate is converted into a third year cost of service calculation, which appears on the vertical access first.

The comparison of the systems in this fashion will demonstrate how each system has an optimum value at which -- a volume at which --- it proves to be the optimum. I'm sorry.

The comparison of the three, and our design volume of 2.4, we find we are 42 by 1440, seems to be the most optimum and as a result, we selected the 42 inch.

Q Might the photograph of that slide be marked Exhibit 237.

(PHOTOGRAPH OF SLIDE MARKED EXHIBIT 237)

Q Mr. Hensch, Slide Number 2 is just a further illustration of this method of

prepared cost service of service to flow.
What we have here are just the comparisons of different operating pressures / symtems for a 42 inch pipe, with 24,000 H.P. we're able to track out each system to find the minimum at a particular volume. Here again, the 42 inch, 1440 system has proven to be the most economical at our designed volume of 24 hundred million.
The 42 inch 1440 system might be rated to operate at 1250 has also been included, on the sketch and appears as the yellow one here.
Once the criterion of safety of design has been applied to the pipeline design after the economics have been carried out to determine the right system we found our economics moned up to the yellow line.

Q The safety factor increases the cost of service?

A Yes. it has. We've not shown the other systems with the same impact on the premise that relatively they would all move upward.

Q Might the copy of that slide be marked as Exhibit 238.

(SLIDE MARKED EXHIBIT 238)

Q Mr. Hensch, could you now explain how system deliverabilities are affected by either compression unit or chilling unit outages.

A Gas compression on the proposed Foothill system is accomplished by 17 compressor stations. The northerly 13 of these stations are to consist of 24,000 ISO Horsepower turbo compressor units, for gas compression and 15,000 ISO horsepower units for gas cooling while stations 15, 16 and 17 contai

29,200 ISO horsepower units for gas compression only. Considering first gas compression unit outages, the system deliverability is naturally dependent on the number of units down and the locations of these particular outages.

When the system is fully powered and assuming a single compressor unit outage, the system deliverability can range from 2,170 million per day to 2,310 million (receipt) under summer conditions, and from 2,275 million to 2,380 million under winter conditions. For a two unit outage, the system capability ranges from 2,170 million to 2,220 million receipt for summer conditions, and from 2,185 million to 2,280 million under winter conditions. Finally, for a three unit outage, the system deliverabilities are 2,125 million receipt for summer and winter conditions respectively.

Table 3B-13.14 of the submission outlines in detail the seasonal delivery volumes as anticipated. The annual delivery from station 17 is expected to be approximately 850 BCF, whereas the normal seasonal average delivery volume is approximately 840 BCF. It is evident, therefore, that the system is capable of delivering the average receipt volume of 2,400 million cubic feet per day on an annual basis, even when station outages are considered.

Considering now the effect of chiller outages, the system deliverability is not seriously affected under these conditions. Average day flows can be maintained for both winter and summer periods, and this is accomplished by reducing the temperature of the gas discharging from the station upstream of the outage to 10 degrees from the normal 25 degrees Fahrenheit. The gas temperature, however, is not allowed to drop to less than zero degrees Fahrenheit. In any case, for the fully powered system as per year

5 and a single unit outage, the system deliverability is in the order of 2,360 million per day. Chiller unit outages can generally, therefore, be counteracted so as not to seriously affect the system deliverability.

MR. GIBBS: Mr. Commissioner, this panel is now available for cross-examination.

CROSS-EXAMINATION BY MR. MARSHALL:

Q Mr. Mirosh, on page 2 of your prepared evidence, question 3, in your answer you are dealing with differences between the two systems and you state at the top of the page, "In contrast Foothills would cease chilling and ensure that gas temperature remain above 32 degrees F south of Fort Simpson. Have you found that reference, sir?

MR. MIROSH:

A Yes.

Q Could you take a look at figure 3B-13.11, which is one of your flow diagrams.

MR. GIBBS: Can you give us the number of the volume?

MR. MARSHALL: Part 3, facilities.

A 13.11?

Q I think it should be 13.5, or 13.11, have you found that near the back of the volume?

A Yes, I have that.

Q Sir, my instructions are

that this shows, among other things, the temperatures of the gas as it enters stations and leaves them, is that correct?

A Excuse me, I didn't hear that?

Q Did you want a copy of this?

THE COMMISSIONER: Justwait until I get a copy of this. Do you want to start again with your questions on this?

MR. MARSHALL: Certainly, sir.

Q Mr. Mirosh on page 2, question 3, you were dealing with the differences in the two systems and you say, "In contrast Foothills would cease chilling and ensure that gas temperatures above 32 degrees south of Fort Simpson", and the reference then is to figure 3B-13.11, which is a flow diagram in the Foothills' application materials.

To begin with sir, why is it important that the gas temperatures remain above 32 degrees in this area south of Fort Simpson? What's the purpose being served?

A Well the primary reason that we are taking this approach is that generally south of Fort Simpson, we understand that there is far less permafrost in the discontinuous zone than there is in fact permafrost, so that we feel that degrading this small amount of permafrost is far less of a problem to our pipeline design approach than it would be to create a bulb of permafrost through most of the non-permafrost

zone.

Q And it's a matter of some concern then, to make sure that you're able to maintain the temperature above 32 degrees Fahrenheit in this area, is it?

A Pardon me?

Q Yes, to make sure that the gas temperature does remain above 32 degrees in this area?

A THat's the approach we have taken.

Q Sir, it is my instruction that this particular diagram shows that gas leaves station number 14 at 44 degrees Fahrenheit, and it arrives at station number 15 at 26 degrees Fahrenheit. Do I misread the diagram?

A No, that's correct, we have picked that up here.

Q What does that mean?

A I'm advised there is an asterisk missing off this particular drawing, which is present on other drawings of an earlier number in that sequence, which refers to a gas heater which is installed at station 14, and which, if it were the case, would increase the discharge temperature from 14 such that the temperature into 15 would be higher than 26 degrees as shown.

Q Sir, has any consideration been given to Foothills to the impact on the throughput that the operation of such a heater would have?

A Well it obviously does affect the throughput. The higher the gas temperature is, the tighter that line suction would be.

Q Do you know precisely, sir, what effect the heater would have at this location?

A I don't think we could answer that now, no.

Q Do I take it this was something that was discovered after the application materials had been printed?

A Yes, I think you could say that this particular schematic must have been an oversight.

Q Well is it the schematic that was an oversight, sir, or was it that it wasn't realized that the result was going to be that gas would be at 26 degrees, that is below the 32 degrees Fahrenheit temperature that you are trying to maintain?

A No, the schematic obviously shows 26 degrees, and had we picked that up we would have increased the discharge temperature out of station 14. I would call that an oversight.

Q Sir, my information is that at maximum flow conditions at which you must operate at certain times of the year, that you have only one percent excess horsepower, either in the winter or the summer, with which to operate this heater. Do you know anything about that?

A Well the heater doesn't operate with horsepower. Did you say one percent excess

horsepower to operate the heater?

Q One percent excess at station 15 to make up the loss?

A Yes, this schematic shows station 15 horsepower to be very nearly used up.

Q Would it not follow then, sir, that at the higher flowing temperature, it would result in reduction of the throughput?

A Yes, there would be some reduction.

Q Has this been calculated?

A There would be a reduction after the horsepower is used up, I should clarify that.

Q I see. Do you know what that reduction would be, sir?

A I don't, no.

Q Do you have any information, sir, as we have not been able to find it in the application, as to the size of the heater and when it would be operated and so on? Do you have such things as design notes or cost Data on it?

A Yes, we have. Mr. Lazerte is able to comment on that.

MR. LAZERTE:

A Yes we have design calculations on the heater, and just to clarify or to add to what Mr. Mirosh said, the whole intent in this area, and it shows on an earlier sheet, namely 13.4, -- excuse me, let me find the correct sheet. The

correct number is 13.3. If you look under station 14, there is an asterisk beside the temperature of 20 degrees on that particular sheet, a note down below, and it says "Operate heater", and you will notice also on that particular sheet, that coming into 15 we show 16 degrees.

Now, the whole intent here is to operate that heater as a trim heater, and we didnot feel we had time to go back and make these small adjustments, so we simply added that footnote and obviously missed it on one or more drawings. The second deal, I believe you mentioned the costing of the heaters.

Yes, they were costed -- sized and costed. My recollection is that there's five of them, they are very large. They were priced out by National Tank.

MR. MARSHALL: I wonder if that data might be made available, Mr. Gibbs?

MR. GIBBS: Yes, as long as it doesn't violate some competitive situation with National Tank. Mr. Lazerte could tell me that.

MR. LAZERTE:

A I rather feel -- well perhaps we could give them everything but the cost material.

MR. GIBBS: Would that be sufficient for you?

MR. MARSHALL: Yes it would.

MR. GIBBS: All right, we will

undertake to provide that, sir.

MR. MARSHALL: Thank you.

Q Mr. Mirosh, turning to the third page of your prepared evidence, you are dealing with an answer to question 4, I'm not quite certain whether or not you amended the testimony from what was circulated. In the middle of that paragraph, if I could pick up the sentence, you are saying, "...could carry an average day receipt volume of approximately 2.4 BCF per day a minimum cost of service for that particular configuration". Did you add "at a minimum cost of service"?

A Yes I did.

Q DO I understand correctly, though sir, and I'm thinking of the comment that you make at page 5 in your fifth answer, that really 1,440 PSIG produces a lower cost of service?

A Yes, it does but under the assumption that he would be able to carry a larger, or that a larger volume of gas would be available. If you carried the same volume, that is 2.4 at the higher pressure, I believe the cost of service would be higher than at 1,250.

Q Sir, do I understand correctly that the original proposal of Foothills was to carry the 2. -- was to carry the higher volume at the 1,440 PSIG, and that because of metallurgical considerations, the system was in effect derated to the lower throughput level,and/ the lower operating pressure?

A No, I don't think that's quite the sequence. The beginning point was the volume, and that determined the size and ideally had we had more volume, and had we had confidence in being able to operate at higher pressures, that would be the way to go, but it happens that the volume which we have selected, 2.4, matches the reduced pressure of 1,250.

Q What I guess I'm interested in, sir, is what came first?

A Between --

Q Was it the 2.4 figure that came first or was this a figure that was developed

after the original concept was developed of operating at 1,440 PSIG with a 42 inch line?

A Well we were given the volumes by Mr. Mackie and that was a number he suggested we try to deliver.

Q Well then to pick up a word that Mr. Hensch has used about derating of the system, do I take it then that there was no derating of the FOothills system, that it was always intended to transport the lower volumes at the 1,250 PSIG pressure?

A Well the intent was always to deliver about 2.4 BCFD. It happens that we can do it with the system we are proposing, at a minimum cost of service.

Q Sir, there is reference in this panel's evidence to the possibility of the pressure being increased to 1,440 PSIG. I believe there are two statements to that effect in the evidence. You are aware of those?

A Yes.

Q Can you tell me sir, what Foothills' intentions are with respect to operating pressures?

A Well certainly the station spacing is designed at 1,250 pounds, so our intent is to operate at 1,250 pounds, but we can't escape the fact that if we felt comfortable and were able to prove to ourselves and to the regulatory authorities that we could go to a higher pressure, and if there was more volume to justify that, that would be one of the

possible ways of increasing the throughput. Down the road, when we were looking at larger volumes, we would evaluate increasing the pressure against adding loop against adding compression, that would be one of our thoughts, but we would have to verify that we could elevate the pressure from 1,250.

THE COMMISSIONER: Would this be a convenient time to adjourn for coffee?

MR. MARSHALL: Yes, it would, Mr. Commissioner.

THE COMMISSIONER: We will take a break for coffee. I felt we would sit tonight and I thought that we would carry on with morning and afternoon sittings the rest of the week, with evening sittings on Wednesday and Thursday as well as tonight. If it turns out that that's something the counsel are not happy with, they can let me know in due course.

(PROCEEDINGS ADJOURNED)

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL:

Q Mr. Mirosh, when we broke off, we were discussing why it was Foothills ended up with pipe operating at 1250 PSIG, 42 inch diameter pipe and 0.540 inch wall thickness. Now I believe you explained that that matched the projections of gas requirements and gas availability from the Delta, and this really produced the optimum system, am I summarizing your comment correctly?

A Yes, I think it's fair to say that if 2.4 BCFD were being received at the top end. that the system we propose would carry that gas at a minimum cost of service.

Q Well sir the difficulty I have then is with the Exhibit 238 which was the first year cost of service versus flow rate diagram that was presented by your panel. Do you have a copy of that sir?

A Do you have a copy of the coloured version?

Q Do I understand Exhibit 238 correctly when it suggests that for a volume of 2400 MMCFD, which is the proposed volumes to be transported by Foothills, --

A Yes.

Q The cost of service, first year cost of service on a cents per MCF for 100 miles basis, which is the chart of the scale on the left hand side, for 42 inch pipe, of .54 wall thickness, operating

at 1440 PSIG, would be approximately 2.5 cents, whereas when the pressure is reduced to 1250 PSIG, the tariff would be approximately half a cent higher, roughly, it's difficult, there's no lines on this graph, but I would say roughly 15 to 20 percent higher cost of service. Do I read the exhibits correctly sir?

A That's probably an interpretation, yes.

Q Well is it the right interpretation sir?

A Well it's difficult to extrapolate but it looks about what it might be.

Q Well then sir, wouldn't your optimum situation with 42 inch pipe of 0.54 wall thickness be to operate at 1440 PSIG, because that would result in a cost of service that would be roughly 15 to 20 percent lower than if you were operating at the lower pressure?

A Yes, I think we stated that operating at the higher pressure would be a lower cost of service but again, we have been advised that due to the metallurgical constraints due to the stress level of internal pressure, we should back that pressure off to 1250.

Q Well I want to get into those metallurgical considerations in a minute sir, but just dealing with that fixed volume, if you like, of 2400 MMCF per day, which Exhibit 238 has selected, metallurgical considerations aside, your optimum situation for 42 inch pipe would be at the 1440 PSIG level, would it

not?

A Well, in fact, this graph shows that at 1680, and if you had higher throughputs, there would be another optimum.

Q That's using pipe of different wall thickness.

A Correct.

Q Than what Foothills has selected. Using the pipe that Foothills has selected 42 inch and .54 inch wall thickness, there is an advantage to the consumers, if you can operate at 1440 PSIG rather than at 1250 PSIG?

A Yes, if the system is as shown here, that's true and I believe that this is correct. But again, we don't feel that we can do that.

Q Well we'll get into that in a minute sir, but we're talking about a 15 to 20 percent higher cost of service, because of derating of the system to 1250. It's less than the optimum. Granted there are reasons which we'll get into. Isn't that so sir, that there is a 15 to 20 percent penalty involved in the cost of service in derating the Foothills system to 1250 PSIG?

A There is a penalty involved in derating yes.

Q And is it within that area, 15 t0 20 percent?

I admit my estimate may be a bit rough but taking it from your graph, which my copy does not have all the graph lines drawn on it.

A I would say that if that's what you calculate, then that's probably what it is. But that may not be necessarily the case in the final analysis if one did a full cost of service for all the years.

Q Well sir, am I to take the graph that is Exhibit 238 as being accurate or am I not?

A It's accurate for a first year cost of service, and with the parameters as Mr. Hensch described for undertaking that.

Q All right then sir, when Foothills is faced with this 15 to 20 percent penalty if you like, or increase in its cost of service, through derating its system, did it give consideration to any other steps that it might take other than derating to 1250 PSIG which might minimize the penalty, if you like, that the consumers would ultimately have to bear?

A I think to be fair we looked at 42 inch and decided that was the right size, and that that was the right wall thickness, and stuck with that.

Q Were there optimization studies done to determine whether some other pipe size, or some other wall thickness or combinations thereof, would produce the lower overall cost of service?

A Well I believe the other curve which was displayed showed other studies which were carried out.

Q Do I take it sir that

Exhibit 237, which I take it is the document you're referring to, and shows three different combinations 48 inch, 42 inch and 36 inch pipe with the wall thicknesses and pressures indicated thereon, sets out the various combinations and alternatives that were considered in these optimization studies or is this part only of the work that was done?

A I think in the application, material, we have displayed other studies in addition to these.

Q The point of interest to me on Exhibit 237 is that while you show 42 inch pipe of 0.54 inch wall thickness you show it at 1440 PSIG rather than at the 1250.

A That's correct.

Q But I took it from your answer that you had determined that that was out of the running, if you like, but because of metallurgical considerations, you had to -- if you were using pipe of that specification, you would have to go down to 1250 PSIG?

A We certainly, as I have stated, would consider it downstream when we looked at expansions, but for designing the system we used 1,250 pounds for station spacing.

Q Do you know where the 42 inch pipe of .54 inch wall thickness at 1,250 PSIG comes out on Exhibit 237? Where would the curve be in relation to the other three?

A Well I think if you took the previous exhibit and super-imposed it, then that should be how it comes out.

Q Do I take it from your answer sir, that Foothills, because of the metallurgical considerations, simply decided to derate the 42 inch system to 1,250 and did not really consider taking other steps that would allow a 42 inch line of the same wall thickness to be operated at a high pressure, higher pressure, say 1,440?

A Well we weren't really aware of any other steps that were proven that we could apply.

Q Did Foothills give consideration to putting crack arrestors on its 42 inch line?

A We had discussions on these but in these discussions we never did feel that crack arrestors were a solution that we could feel confident in.

Q Well sir, I believe we

discussed the problem that Foothills was having in that derating the system to 1,250 really imposes a penalty on consumers of 15 to 20 percent from what your study showed would be an optimum pressure, that is 1,440. Did it not seriously study other ways, other solutions that would allow the pipeline, the 42 inch pipeline to be operated at 1,440? You say you had discussions about use of crack arrestors. Did it not have detailed studies carried out?

A Well we were aware of studies carried out in the study group up to the point at which Alberta Gas Trunkline withdrew, and these studies we never felt were conclusive, at that stage. We have not carried out studies in that regard ourselves, but I might point out that although the first year cost of service does show a penalty for derating, the reason for that derating is to reduce any possible future penalties due to unstable crack propagation which may occur. So that in effect, it's an insurance for the consumers.

Q Well that would get into a question which I presume the metallurgical panel might better be able to deal with, and that is whether the pipe of the specifications chosen has the ability to resist the propagation of fractures.

A Yes.

Q Do I take it that that's an area that you're not expert in, and it should be left to the metallurgical panel?

A Yes.

Q Do I take it from the answer you've given me to the question preceding that, sir, that Foothill's has not carried out any studies as to the costs that would be involved in installing crack arrestors on a 42 inch line of the type proposed in the application?

A That's correct.

Q Would it surprise you, sir, to find that the installation of such crack arrestors, would result in an increase in the capital costs for the pipeline, that were taken in the broad picture, rather insignificant, and would have very little effect on the ultimate tariff?

MR. GIBBS: Surely my friend is starting to give evidence on the use of crack arrestors and their capital cost, and my witness has said that he doesn't have much faith in crack arrestors, so there's really not much point in asking him whether it surprises him that they are expensive or inexpensive.

MR. MARSHALL: I can rephrase the question.

Q In carrying out the discussions that you say you've had about crack arrestors, have you considered the additional capital cost that would be required in order to install them?

A Well we really hadn't, because in order to do that, we would have to have felt that we could apply them, and we never did get to that stage.

Q Sir, in not getting to

that stage, did you rely upon studies that were commissioned by Foothills? You say you never got to the point of feeling that you could apply them. In reaching that decision, did Foothills have the benefit of expert advice that's incorporated in reports or studies?

A Well as I indicated earlier, we had access to material which the study group had prepared up until the point of Alberta Gas Trunkline's withdrawal, and on that basis, our experts have not pointed out to us that we should be applying crack arrestors.

Q Has FOothills had any additional studies carried out?

A No sir, but we are planning studies and in fact they may be undertaken shortly.

Q What is the intended scope of such studies, sir?

A TO study the stress concentrations of crack arrestors on a pipeline.

Q Who will be carrying out that work, sir?

A Foothills.

Q Are there any other studies that are intended in this subject area?

A We don't contemplate any others at the present time, no, sir.

Q Sir, at page 5 of your prepared evidence in answer to question 6, you say, "at station 17, gas discharge temperatures will be limited to 80 degrees Fahrenheit by an aerial cooler".

Have you found the passage,sir?

A Yes, I have it.

Q Could you tell me, sir, what the approach temperature is for the aerial cooler?

A I would be -- I think I could pass that on to Mr. Lazerte, although he has written 30 degrees down for me.

Q Could you explain what the approach temperature means?

A Could I let Mr. Lazerte carry that on?

Q Fine.

MR. LAZERTE:

A The approach temperature is the exit gas temperature, minus the ambient air temperature, and the 30 degrees used is normal in the industry.

Q DOes it follow, Mr. Lazerte, that if the ambient temperatures are greater than 50 degrees Fahrenheit, the discharge temperature will be more than 80 degrees Fahrenheit?

A No, it does not.

Q Could you tell me, sir, what the discharge temperature would be if the air temperature were, say, 70 degrees? With an approach of 30 degrees?

A Would you ask the question again please?

Q Could you tell me what the discharge temperature would be, assuming your 30

degree approach temperature, if the air temperature were 70 degrees?

A I would expect with that ambient air temperature that we would exceed the -- could possibly exceed the temperature of 80 degrees on the outlet. Again, this comes down to exactly how much beef, as it were, that you put into the design of this unit, and in our final design, certainly we recognize that temperatures in this area are going to hit 80, 85 degrees, and we'll design accordingly.

Q Well sir, if you had temperatures even of 60 degrees, would you not be discharging air at more than 80 degrees Fahrenheit?

A As I recall it, the ambient used was approximately 60 degrees.

Q What results would obtain if it's an ambient of 60 degrees?

A We might hit close to 80 with certain conditions built into the unit.

However, I might add I understand the thrust of your question, but my whole feeling, or the feeling is that if we do slightly exceed that 80 degrees on that line, the said effects are not going to be of any consequence -- of serious consequence.

Q If it was considered necessary by Foothills to keep the temperature to no more than 80 degrees as has been indicated in the testimony, would it be necessary when the ambient temperatures were high to reduce the throughput?

A No we wouldn't take that approach, we'd build a little more area in for very little more money and handle this in the final design. I think the wording here is a little bit loose, but it expresses general intent.

Q The final design work has still got to be done, with respect to this heater?

A Certainly. We have had quoations on this equipment but certainly we'll be looking at these finer points in the final design.

Q Now Mr. Lazerte, you described in your evidence at some length why you have allowed for excess compressor Horsepower at station Number 1, at capacity flows, I believe, if I understand it correctly, there is about 50 percent excess at that station, is that correct.

A Yes.

Q I wasn't quite sure as to why that had been allowed or designed for and perhaps if I could just run through it and see if I understand correctly, did you -- do I understand correctly that you used sort of a conservative approach in providing excess capacity at this station, because of your concern about the possibility of the gas compressor at the TAGLU Processing Plant going down?

A Yes.

Q Do I understand correctly as well sir, that you have assumed that the compressor at the Taglu station will be of the same general design as that used in the Foothills system?

A Yes, they showed that on their flow diagram.

THE COMMISSIONER: Who is they?

A. Gulf, Imperial and Shell in their four volumes submitted to DIAND had a process flow schematic of both plants and it showed on that schematic.

MR.MARSHALL: Q Why do you consider it so important to have the excess capacity at year number one station?

A Well precisely I guess because it is the first station on that line. and by being able to restore the pressure of course, it's the vital link on the line.

Q Well what I don't understand is this sir, if you've got basically the same compressor at the Taglu Processing Plant as you have at your stations one, two, three, four, five, six et cetera, isn't it just as likely that one of the Foothills compressors will go out as it is that the Taglu compressor will go out of service?

A Yes, I think that that's true.

Q And don't you have the same consequences in terms of decrease in your throughput, if one of those other stations goes out?

A I think Mr. Hensch's

testimony covered compressor outages on our line, today.

Q Well I'm interested though sir in your response to this because it's in your testimony. Really, isn't there the same result, if one of the other compressors goes out, as if the Taglu Processing Plant Compressor goes out? They're basically the same piece of equipment.

A No, but they're operating under different conditions, of course the Taglu booster compressor will be taking suction at 1080 so I guess if we were going to do an analysis like you suggest, we would have to get into some specifics.

Q Well sir, if compressor station 4 were to go out, would the suction at compressor station 5 be much off 1080?

A I'll yield that question to the expertise of our hydraulic designer; I believe.

WITNESS HENSCH:

A I can't tell you, I'm sorry. I would have to take a check on some flow studies and see what they would look like.

Q What I'm getting to, Mr. Lazerte is this. It seemed to me that the job that was being done by the unit at the Taglu Plant was pretty much the same job as was being done by the compressor units all the way down the line. Is that not a correct assumption?

WITNESS LAZERTE:

A The general statement is correct, the specific statement probably is not.

Q Well then if you're building in the over capacity at station Number one why don't you also build it into station Number two and three and so on, all the way down the line?

A I think we should look how this generally developed. As a general comment, I'd say that when we first went into the initial design on the system, that as a simplification and not knowing where the origin of the gas was, that we took the gas, we took all of the designed gas in at the north end of the system. I think then it's fair to say that on the original runs then, Number one compressor became located at, I think it's Mile 46, then followed the more detailed runs and examining the horsepower there, we made the decision as outlined in the transcript.

Q If I understand you correctly sir and you've expressed I think what my advisors had thought was probably the case, that in doing your initial flow studies, you simply assumed all the gas was coming from Taglu.

A That's correct.

Q And you did not incorporate any gas from Parsons Lake or you assumed those Parsons Lake volumes were coming from Taglu?

A Initially yes.

Q Yes.

Sir, with respect to the location of that Station Number one, don't you think it would have been better located downstream of the Parsons Lake lateral junction?

A No, we looked at this in detail, and found that was not the case. I'm not prepared at this moment to go into the specifics of all that, but roughly, a week's work was put into that analysis and the recommendation was to leave it sited where it is as being the correct site.

Q Do I understand then that after the supply picture changed, you made no change to the location of your compressor stations to what had initially been selected?

A There was shifting, minor shifting of stations of course, for reasons that you have been told, I think in other panels. But, there was no -- with the exception perhaps of one of two, there was no major shifting, particularly of that station.

Q Particularly of that. Sir, you mentioned that a detailed analysis was done of the location of this station. I think you mentioned there was a week's work involved in it. Is there a report that pertains to that?

A There's an internal report in Foothills, yes.

Q I suggest Mr. Gibbs that might be relevant to the evidence of this panel and might we have a copy of that.

MR. GIBBS: Well sir, I haven't seen it. Unless there's something of a confidential nature which we want to claim privilege, certainly we'll produce if and if we do want to claim some privilege, we will advise my friend and the inquiry.

MR. MARSHALL: Thank you Mr. Gibbs.

Q Sir, at page 7 in answer to question 11, you make a comment about the possibility of the Foothills system ultimately operating a 1440 PSIG, and this Mr. Mirosh commented on, on this as well, It was his comment I believe, that it would have to be demonstrated that it was safe to do this. I was just wondering what type of information would have to be made available to Foothills before it would be satisfied with respect to the safety of increasing the operating pressure to 1440. What is it that you have in mind, is it a period of successful operating at lower pressure or is it some test information, what is it you have in mind in making that statement?

A Mr Mirosh, is much more -- has much more expertise in this area and I wouldn't want to comment.

Q Mr. Mirosh?

WITNESS MIROSH:

A I think you mentioned one possibility and that is gaining operating experience, as studying how the system operates at 1250 pounds. But I think before we made a major increase in pressure we would probably have to carry out some metallurgical tests. There are a number of ways we could go, one way might be to, if we felt confident in operating at 1250 and had some analytical proof that we could go higher, possibly incrementing the pressure by small steps if and when this was approved by authorities, but the other more likely

way would be to carry out metallurgical testing.

Q It's the first suggestion that I want to deal with sir. That is related to operating experience. Do I understand you correctly that you would operate at 1250 PSIG and then if you didn't have any difficulties at that pressure, then you might consider increasing the pressure incrementally?

A If at some point in time we found that there were additional volumes available and if we determined , after a study, that it might be possible to do it by increasing the pressure, and we would feel confident in it, as opposed to looping or adding compression.

Q Sir, if you're operating at 1250 PSIG, correct me if I'm wrong, that doesn't tell you anything about the behaviour of the pipe in the event of a ductile fracture, if you're operating at a higher pressure, does it?

A It does tell you how the pipe behaves under permafrost conditions, something which I believe very little experience is available on currently, but truthfully, one would probably have to carry out metallurgical testing in order to verify that pressures can be raised.

Q Mr. Hensch, do I understand correctly that Foothills has assumed that pipe roughnesses of 0.002 inches would be obtained in developing its flow calculations?

MR. HENSCH:

A Yes.

Q This is in contrast with the Arctic Gas estimate of 0.003 inches, is that correct?

A Yes it is.

Q You're aware of that difference?

A M'hmm, yes we are.

Q Which is really a 50 percent difference?

A A 50 percent difference in roughness, yes.

Q Have you calculated the effect on throughput, sir, if Foothills was unable to obtain pipe with that pipe roughness, 0.002? But rather was able to obtain it only with a roughness of 0.003 inches?

A We've made studies and I'm afraid I can't tell you quantitatively the difference

in the throughputs. If I recall, they were quite small, the differences in the capacity.

Q The figure that has been given to me by my advisors, is that there would be a reduction of about 1.6 percent of annual throughput, if the greater roughnesses resulted?

A 1.6, that would be 24 million a day. Is that so?

THE COMMISSIONER: A reduction of, not a reduction to, is that right?

MR. MARSHALL: Reduction of about 1.6 percent of annual throughput.

A That's in the order, yes.

Q I was wondering, sir, what it is that you base your conclusion upon that you will be able to obtain pipe with a pipe roughness of 0.002?

A We have been able to obtain some information prepared by I.G.T. and published in their Monogram 10, I believe. We make reference to it in the Foothills' application, and in that applicat-ion they have stated the roughnesses of plastic lined pipe, to vary from 200 to 300.

THE COMMISSIONER: What did you call that, I.G.T.?

A I'm sorry, Institute of Gas Technology.

MR. MARSHALL:

Q If I understand you correctly, sir, the information that you had to work

from indicated that the range was from 2 to 3, and you have selected the lower end of that range?

A Yes.

Q Do you have any reports or data in written form, which indicates to your satisfaction that you can indeed obtain pipe at that roughness?

A I don't have any such reports, no. Possibly the Foothills people might.

Q Sir, in the Foothills' application, part 3, Tab B3, section 3.2.2, could you get that in front of you please?

A What was that section please?

Q Page 3B, -3.4, the volume that's entitled "Part 3, Facilities". Do you have that?

A 3.4 or 2.4?

Q 3B, 3.4? It's under a section that's 3.2.2, to add some confusion to this.

A I'm sorry.

Q The second paragraph I think is the one that we are interested in, sir. It says, "During normal pipeline operation, the propane unit will be operating at less than half of its rated power, while full power will be used only when there is a chiller system outage condition at a downstream compressor station". Do you have the reference?

A Yes, I have that.

Q You say, at page 3B13.2,

the exhibit, and it's just a short statement, I think I have got it accurately here, "A single chiller outage will not impair delivery of volumes as all chilling systems have been designed with sufficient excess capacity to contend with such an eventuality".

A Yes.

Q Do I understand this to mean that the chiller upstream of the chiller outage, has sufficient design capacity to draw down its discharge temperature sufficiently, so that the gas compressor station with a chiller outage, can work at full capacity without exceeding the station design discharge temperature?

A Yes.

Q Now sir, in reaching this conclusion, has consideration been given to the transient heat flow properties of the soil surrounding the pipe?

A Excuse me, I'm -- could you repeat the question please?

Q I can approach it another way. You havea chiller outage at a particular station, and as I understand the exhibit, you are counting on excess capacity at the upstream station in order to provide additional chilling --

A That is so.

Q -- so as to ensure that the gas that goes through the chiller, the compressor station having the chiller outage, does not exceed 32 degrees Fahrenheit?

A After the compression process, yes.

Q Now, in other words, you have got to cool the gas at the upstream station or stations, to lower temperatures than you ordinarily would, so that even though it has to go through a station at which the chiller is not in operation, the gas temperature is not going to get up above freezing?

A Does not rise above.

Q Okay, now, you made a statement to the effect that you're going to be able to do this because you've got sufficient capacity in that upstream chiller, so that it can provide the additional chilling required, okay?

A M'hmm.

Q We're together?

A Yes.

Q Now there are a couple of things about that, sir. The first one is, these stations are some 40 to 50 miles apart, are they not?

A Yes.

Q And am I right that for the gas to get from the upstream station to the station where the chiller is out, would take maybe 3 hours, something in that order?

A It would depend on your mathematics there, I'm not -- that's probably right, the order.

Q Well, do you know or does Mr. Mirosh know about how long it would take for gas to

get from one station in the system to the next station?

MR. MIROSH

A Well I think I would have to state that under full flow conditions the gas might be travelling about 30 miles an hour, but I haven't done that calculation.

Q In any event, there would be a time period --

A There would be a time period, yes.

Q -- would there not? And my advisors indicate that it would be about three hours for the gas to get from the upstream station to the station where the chiller is out. Perhaps we -- if you could accept that for purposes of our discussion, subject to your recalculating it at a later time, it would follow, would it not, sir, that during this three hour period, if you like, there would be a problem at the station where the chiller was out, because the gas temperature would rise up above 32 degrees Fahrenheit, and you still don't have any cooling effect from the upstream station , because it takes three hours for the gas to get from that station down to where you have the outage, right?

MR. HENSCH:

A Okay.

Q Further, as the gas is travelling from that upstream station to the one having the outage, would there not be a flow -- would there not be a heat transfer from the soil surrounding the

pipe to the gas within the pipe? Because you will have much colder gas exiting the upstream station than you previously had, and the frozen material surrounding that pipe will be at a warmer temperature, so there will be a transfer of heat from the frozen anulets around the pipe into the pipe, into the gas and it will get warmed up that way.

A You are probably correct there, yes. It could warm up, but the conduction, if we were finding that the conduction effects in the temperature profile calculation were not as significant as were the effects of the expansion of the gas, and I guess --

Q But that is under steady state conditions, and not transient conditions?

A Well, I'm not sure about that. I can't see why they would not apply to the transient.

Q I see, have you studied that aspect of it?

A No we haven't, no.

Q You agree with me, though sir, in general terms, there would be a transfer of heat from the area around the pipe into that super-chilled gas, if you like, the gas that's been cooled to a much lower temperature in order to make up for the outage downstream?

A Yes, potentially there is a small amount of --

Q And as a result of that

warming of the gas, if you like, it's going to take even longer than our three hour period in order for you to be able to start to chill the gas below 32 degrees Fahrenheit, on the discharge side of that station experiencing the chiller outage?

A THat is possible, we have not -- we have not made these studies, and I'm afraid I can't answer the question.

Q Well during this period of three hours plus, whatever it may be, what's happening downstream of the station having the chiller outage? Are you not having thaw around the pipe downstream of that station?

MR. MIROSH:

A I wonder if I could add something. There is one obvious thing that could be done and that is that particular station horsepower could be cut back for a few hours. That's an operational refinement which I'm sure would be developed if this thaw did occur.

Q Doing that, of course, would have an effect on your throughput?

A It would give you a temporary reduction in throughput, until the system stabilized, yes.

Q And is it fair to say, Mr. Mirosh, that as this matter hasn't really been studied in detail, you're not able to say how long you would have to have a reduction in throughput, nor indeed what the extent of that reduction would be?

MR GIBBS: Surely sir that is an impossible question. You have to determine the reason for the outage to start with and whether it's three hours or an hour,and a half and what the ambient temperatures are and so on. I don't see how anyone could be expected to answer that.

MR. MARSHALL: Well I take it it hasn't been studied anyway, so I can leave the point.

Q Mr. Mirosh, you would agree with me though that it may well be necessary to reduce the throughput in the event a chiller is lost from the system.

WITNESS MIROSH·

A I think I would agree with you to the point that we haven't really looked at it yet, but I didn't quite follow your thinking earlier, in that there is a Joule-Thompson temperature drop which is always reacting oppositely to any heatflow into the gas so that I think you were implying the gas was picking up heat and therefore increasing in temperature, which it may do due to conduction but there is an opposite effect of Joule-Thompson which is in fact pushing the temperature down, albeit in a transient or steady state condition, and we haven't looked at this. But the two do operate against each other. so it's not a simple matter of picking heat up.

Q Mr. Hensch do I understand correctly that the chillers planned for use by Foothills will have a designed heat exchange rate of 84 million BTU's per hour?

WITNESS HENSCH: I'm afraid I'll have to turn that over to Rolly. He's more familiar with the design of the machinery.

WITNESS LAZERTE: Excuse me, I was talking to Mr. Mirosh.

Q Do the chillers planned for use by Foothills have a designed heat exchange rate of 84 million BTU's per hour?

A Yes.

Q Does this fix the designed propane flow rate on the physical size of the propane compressor?

A Yes.

Q Is it true that propane compressors can only operate within the limited range of propane flow without surging or choking?

A Yes, we've looked at this problem and there are a number of things that we may or may not do. We look at this as a design refinement.

Q You say you've looked at it sir. Are there reports that have been prepared dealing with your analysis of it?

A No, there are not. These discussions were held with vendors of the compressors and I should not say that, perhaps there are, perhaps there are not. Discussions were held and this particular point explored, we would not plan on handling it until the detail design phase.

Q Well sir, I suggest to you

that even if there was excess Horsepower available for much of the year, the capacity of the chillers really cannot be increased to lower the gas discharge temperature much below 25 degrees farenheit at any station for the reasons that we've just discussed. Do you agree with that or do you disagree?

A No. I disagree.

Q Have you done anything to model the performance of the chillers that it is proposed will be used for Foothills?

A No.

We have performance curves on them, performance charts on them and we know what they certainly will do at the design phase, yes.

Q Mr. Hensch, is it correct that the Foothills exhibit material does not allow for or provide for any restrictions to the northern part of the system due to compressor failures in the southern part of the system. That would be in the Alberta Gas Trunk Line's system?

WITNESS HENSCH:

A Could you just repeat that again please. I'm sorry, --

Q Is it correct that the Foothills Exhibit material does not allow for any restrictions to the northern part of their system due to compressor failures in the southern part of the system, that would be A.G.T.L.

A You mean in the discussion of the flows?

Q Yes.
A That is correct.
Q There is an assumption, is there not, that the A.G.T.L. system would be able to take all that Foothills was able to deliver?
A Yes
Q I take it it would follow that the calculations of throughput of Foothills are not really comparable then to those for the Arctic Gas system in that the Arctic Gas system considers this possibility from the northern end right through the inter connection with Trans Canada, whereas Foothills does not?
A That is so, except I believe the calculations of the Trunk Line system have similarly been carried out in sort of paralleling the calculations for the Foothills system and the results there were also that the Trunk Line system could move the average delivery of the Foothills system.
Q I see, is that information found in the A.G.T.L. submission?
A It should be, yes.
Q Perhaps you could let me know where that information is.
MR. GIBBS: My friend is --
MR. MARSHALL: Well he's not certain whether it's there, I've not been able to find it.
MR. GIBBS· He's got a stable of advisors that would fill this room that can read that material and if it's there, it is or it isn't, why he'll

come back and say we need it.

MR. MARSHALL: If we can't find it in looking further, we'll be back to ask for it.

Thank you I think those are all the questions I have.

MR. SCOTT: I think Mr. Bell and Mr. Bayly would be next.

MR. BELL: I have no questions at this moment sir.

THE COMMISSIONER: Mr. Bayly?

CROSS-EXAMINATION BY MR. BAYLY:

Q If I could refer you gentlemen to page 9 of your prepared evidence, the pages aren't numbered but it's question 12, and the chart to which you refer. What I've been confused by and perhaps you can help me, is comparing this chart on -- below question and answer 12 to Exhibit 238. Now, as I read the chart after question 12, the gas flow in the first year, totals 800 million cubic feet, is that correct, per day?

WITNESS MIROSH
A Yes.

Q Now the chart that we have refers to the first year cost of service versus the flow rates and it only refers us to 2400 million cubic feet per day, which as I read that chart, on page 9, doesn't get reached until sometime between the year two and year three.

A Could you repeat the last question please, or the statement that you made?

Q All right. I've referred you to the chart, in question 12 and let me take you to that chart. In the year one, you have a total flow per day, maximum of 800 million cubic feet of gas is that correct?

A Yes.

Q But you don't reach 2400 Million cubic feet per day until year five actually?

A That's correct.

Q Now we've been referred to first year cost of service versus flow rate chart, and it only refers to 2400 million cubic feet per day. I'm assuming that doesn't refer to first year at all, but fifth year, is that correct?

A Well it's a mechanism for comparing various studies, yes.

Q All right, so if we were really to find out about first year cost of service, it's not even on this chart, because the coloured lines don't even go back as far as 800 million cubic feet per day?

A Well I have two offers to answer that question here on either side of me.

WITNESS LAZERTE:

A Well you're quite correct. The chart shows the 2400. The designation first year cost of service is a little bit of a misnomer because really what is being attempted here is that all the capital is spent to put the equipment into flow the 2400, so this chart does not show the cost of service for 800 million a day, you're quite correct.

Q And it really only shows us something after the first year, if I read the line correctly, the coloured lines, starts somewhere after 1,000 million cubic feet.

A That's correct.

really designed to show us the costing in the fifth year.

Q And it is?

A Right, or the year that you reach your full volume build up shown along the bottom?

That's correct.

MR. BAYLY: All right, those are all the questions I have.

THE COMMISSIONER: Mr. Anthony isn't with us today. Mr. Scott?

CROSS-EXAMINATION BY MR. SCOTT:

Q Mr. Mirosh, turning to question 3, which is on page one, I understand that you emphasize there that in contrast to C.A.G.P.L. that Foothills Pipeline will operate above 32 degrees farenheit, south of Fort Simpson and is it correct to infer from this that the lateral that will take gas to Yellowknife will remain above 32 degrees farenheit for its length?

WITNESS MIROSH:

A I believe it will probably approach ground temperature but perhaps one of the other gentlemen on the panel know the details.

WITNESS LAZERTE

A I'm afraid not, I think your

assumption of ground temperature is valid. No studies were prepared on it.

Q Well the difficulty that confronts me is that I take it that the as you Mr. Mirosh I think have explained, the cut off of chilling at Fort Simpson was selected because you concluded that below that, the advantages of chilling began to disappear or had substantially disappeared.

A We felt that there would be less disruption to the right of way, yes.

Q And I take it that the reason you chilled as far as south as Fort Simpson was that conversely you thought the disruption would be less north of Fort Simpson if you chilled in that area?

A That's correct.

Q I take it then that -- has any consideration been given as to whether you should chill to Yellowknife or not?

A No sir, although I believe in our flow studies we have the temperatures that we would project would occur along the lines. I'm not sure if we have them here.

Q Because it's correct to say, is it not, that after it comes off the main line, the gas on the way to Foothills goes -- I'm sorry to Yellowknife, there is not yet a town called Foothills, but the gas that goes off to Yellowknife, goes a very substantial distance north. One only has to look at the map that you have behind you on the left, as I face it, to see that, isn't that so?

A Yes, that's so, and quite a bit of that is in rock.

Q Well has anything whatever been done to determine the virtues of chilling that spur line?

A Well we didn't feel that a small diameter pipeline would warrant the attention that the main line did, but to be specific, we did not study the necessity for placing a chiller on the community laterals.

Q Has any consideration been given to the effect of -- the temperature effects of the unchilled gas, as it leaves Fort Simpson depot and goes to Yellowknife?

A In what sense would you

say consideration?

Q Well for example, to what extent is it going to be chilled naturally?

A Yes, that certainly spills out of the hydraulic studies. There is a Joule-Thompson effect along the pipeline which causes temperatures to drop.

Q And is that the same as saying that if the pressure drops, the temperature drops?

A Yes, as the gas expands.

Q Well, has anything been done to determine when this system is in operation, when or at what times of the year the gas in the spur line is going to be below 32 or above 32?

A Well I believe in our hydraulics studies, I may be incorrect but I believe that the hydraulics studies do in fact show what the temperature profile will be at various points.

Q And can you make that available?

A Well they have been done, I understand. If counsel feels that it can be made available, then --

MR. GIBBS: Well again subject to the same qualification of privilege, and I don't see how there can be any, we will make them available, yes.

MR. SCOTT:

Q Well let me ask you just one other general question, Mr. Mirosh, not you Mr. Gibbs. If there is little or no impact from having no

artificially chilled gas at Yellowknife, does that lead to a conclusion that there may be certain virtues in terminating the chilling further north than Fort Simpson on the main line?

A Well I might make one point, and that is that the energy contained in the gas going to the communities is extremely small compared to the main line, so that disruptive effects to the environment should not be significant. To answer your question about whether there is any virtue of cutting off chilling further north, there might be and perhaps this would be a design refinement that we would be looking at.

On the other hand, it might also be necessary to carry chilling further south. Our current assessment is that Fort Simpson is the place we would cut it off.

Q And I take it that your determination to leave it unartificially chilled to Yellowknife, has no bearing on where you start and stop chilling on the main line, in your judgment?

A Well as I say, the amount of heat energy in the gas is extremely small, it's a small volume, low velocity, small pipeline.

Q Well that's a statement of fact. What conclusion do you draw from that?

A Well the conclusion is that there is not a significant amount of energy in the gas to cause disruption to the environment, as compared to the main line.

MR. SCOTT: That's all, thank you.

THE COMMISSIONER: Any re-examination?

MR. GIBBS: No sir.

THE COMMISSIONER: Thank you, gentlemen. I think that at least so far as your engagement on this panel is concerned, we have completed your evidence and thank you all very, very much.

(WITNESSES ASIDE)

MR. SCOTT: Mr. Commissioner, as to our time table for this evening, I would like to have a short meeting of half an hour with counsel, and I can have that either at the dinner break, if it's elongated by half an hour, or at the end of this evening's sitting. That presents two possibilities. If it conveniences Mr. Gibbs, we could adjourn now until 7 or 7:30, and have our counsel meeting and then have dinner, or we could continue for three-quarters of an hour and break off a little early perhaps this evening.

THE COMMISSIONER: Well you gentlemen decide.

MR. GIBBS: Well my convenience would be to adjourn now. One of my witnesses is on an airplane between here and Calgary.

MR. SCOTT: All right.

THE COMMISSIONER: Well, we will adjourn now until 7:30, and Miss Hutchinson, would

you see if they could bring us coffee tonight around 8:30 or thereabouts?

(PROCEEDINGS ADJOURNED)

MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTTER OF APPLICATIONS BY EACH OF
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES; and
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINES

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.
September 15th, 1975

PROCEEDINGS AT INQUIRY

Volume 61 - A

ALLWEST REPORTING LTD.
4290 CANADA WAY,
BURNABY 2, B.C.

APPEARANCES:

Mr. Ian G. Scott, Q.C. Mr. Stephen T. Goudge, Mr. Alick Ryder and Mr. Ian Roland	for Mackenzie Valley Pipeline Inquiry;
Mr. Jack Marshall, Mr. Darryl Carter, and Mr. John Steeves	for Canadian Arctic Gas Pipeline Limited;
Mr. Reginald Gibbs, Q.C. Mr. Alan Hollingworth	for Foothills Pipelines Ltd.;
Mr. Russell Anthony, Prof, Alastair Lucas	for Canadian Arctic Resources Committee;
Mr. Glen W. Bell and Mr. Gerry Sutton	for Northwest Territories Indian Brotherhood and Metis Association of the Northwest Territories;
Mr. John Bayly	for Inuit Tapirisat of Canada and the committee for Original Peoples Entitlement;
Mr. Ron Veale and Mr. Allen Lueck	for the council for the Yukon Indians
Mr. Carson H. Templeton	for Environment Protection Board;
Mr. David Reesor	for Northwest Territories Association of Municipalities
Mr. Murray Sigler	for Northwest Territories Chamber of Commerce

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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

E.A. Mirosh resumed
A.F. Bauer Sworn
G.W. Walker "
P.G. Glockner "

MR. GIBBS: The fifth panel deals with pipeline design, composed of Mirosh, Bauer, Walker and Glockner.

On Mr. Mirosh's right is Dr. Glockner, on his left Mr. Walker and Mr. Bauer.

Q Mr. Mirosh, you're the manager of engineering for Foothills Pipeline Limited?

MR. MIROSH:

A Yes.

Q You've appeared before this inquiry as a member of other panels in this phase?

A Yes.

Q Can you outline the major differences between Canadian Arctic Gas Pipeline and Foothills' applications in the area of pipeline design?

A There are a few differences in this particular aspect of engineering for this project. One significant difference is that CAGPL has proposed to design and construct dual river crossings on the two pipeline crossings of the Mackenzie River.

In the Foothills case, we propose single pipeline crossings at these two locations. We feel that being selective in the choice of crossing locations and with substantial engineering precautions and suitable installation methods, a single crossing at these two locations would not only be as effective but will in addition reduce river bank and river bed

disturbances. Mr. Walker, a member of this panel, will expand upon this further.

A second difference in this area is that Foothills proposes a 60 foot wide permanent right-of-way for the mainline and a 60 foot wide working space alongside of the right-of-way which would be utilized only during construction. In the case of CAGPL they are proposing a 120 foot wide right-of-way for the entire mainline.

A third area of difference is that CAGPL in its application is proposing intermediate pipeline block valves and Foothills is proposing not to install such valves at locations intermediate to stations.

In the case of stresses within the pipeline, as a result of the reduced operating pressure which Foothills proposes, total stress levels will differ between the two proposals and Dr. Glockner, a member of this panel, will expand upon Foothills approach towards stress calculations.

Q In general terms, can you explain the approach Foothills is taking towards guarding against excessive pipe movements due to frost heave and thaw settlement?

A We are aware and concerned that pipe movement after construction due to both frost heave and thaw settlement will be maintained within safe stress levels for the pipe which we are proposing to use. With this concern in mind, we have initiated studies by our consultants in the areas of geothermal analysis and pipe stress analysis.

Frost heave is of concern only to those parts of the pipeline which are in non-permafrost areas in the discontinuous permafrost zone and where chilled gas is travelling through the pipe. More specifically, frost heave will only occur at locations where fine grained soil with a high water table or subsurface source of water exists. To examine this site specific phenomenon, we are mathematically modelling the pipe together with its surrounding soil and ditch fill materials. Subsurface soil information is currently being obtained from drill hole data which has been made available by the Alberta Gas Trunk Line and from other sources where the drill hole data is taken from locations near our proposed pipeline route.

With this tool of mathematical modelling, we are generating sufficient information so that a series of graphical representations can be made relating anticipated pipe movements due to frost with length of pipe affected (soil conditions and time being the parameters).

At the same time, our pipe stress analysis studies are relating maximum allowable pipe displacements to unit length of pipe. Utilizing both of these sets of information, we will be able to determine how much pipe movement over a certain length is tolerable and how much movement will cause stresses to which safe levels are exceeded. If we find in some intances that pipe movements exceed those which we can tolerate, then we will implement any one of the following design steps which would limit pipe movement due to

frost heave:

Number 1, replacement of ice rich fine-grained material in the ditch with granular material;

(2) Water drainage from the ditch;

(3) Insulation around the pipeline;

(4) Deeper burial or additional overburden;

(5) Pipe restraining saddles with frost anchors.

THe potential problem of thaw settlement will occur in those areas south of Fort Simpson where the warm pipeline passes through fine grained ice rich permafrost soil. Again, as in the case of frost heave, geothermal studies and pipe stress calculations are being carried out to determine the allowable amount of thaw settlement which can occur over a unit length and still not exceed safe pipeline stress levels. We are using drill hole data which Foothills has collected during a program carried out last winter. Should specific areas of concern regarding pipe support become evident during the studies, designs based upon the installation of special pipe support structures could be implemented. These supports, if they are required, would be below the pipeline and would support the pipe in its ditch.

In the detailed design phase, the site specific locations of anticipated frost heave

and thaw settlement problems will be drilled to obtain site specific soil and moisture data. These locations will be noted on the drawings and field engineers, who will be on hand during construction, will be aware of these locations as the ditch is being opened. The field engineer at the time of construction will be able to confirm that site specific support designs will be required and the predesigned pipe support installations will be implemented to the extent indicated during construction.

Q In the Foothills' application, compressor stations are spaced approximately every 50 miles and mainline block valves will exist at the stations. Can you explain why block valves intermediate to the station locations are not included in the Foothills design?

A We have investigated the installation of block valves at locations intermediate to compressor stations and have concluded that such block valves are not necessary for the safe and reliable operation of the pipeline. Block valves at intermediate locations are generally installed to limit the amount of gas which would be lost from the pipeline in the event of a pipeline rupture at locations between the stations. Intermediate block valves, by means of a differential sensing device, can be adjusted to automatically close should the sensing device detect a differential pressure across the valve indicating a line break at some location in that line section.

As the pipeline in the

Northwest Territories is installed in an isolated environment over its entire length, pipeline damage due to third party causes can be expected to be minimal. On the other hand, third party damage in pipelines throughout southern Canada and the U.S. is the major cause of pipeline rupture.

In addition, by specifying the hghest currently achievable toughness for the pipe, the size of a defect which would cause a rupture will be large enough to be readily detected by inspection procedures during manufacturing and construction. An additional factor mitigating against potential pipeline ruptures is the pipeline surveillance technique which will be carried our during the operational phase, utilizing surveillance pigs which will detect defects at an early stage of their life should they be formed during operation.

The above factors, coupled with the initial expense of installing such block valves, and the continuing operational difficulties of maintaing the intermediate block valves at locations away from compressor stations have led us to conclude that intermediate block valves cannot be justified interms of cost effectiveness or necessity.

Q Can you advise of any plans you have to install above ground piping or components on the Foothills Pipeline facilities?

A Our studies to date have resulted in our considering above ground piping and components in the following areas:

1. Above ground pipeline at selected vehicular bridge crossings of rivers on the Yellowknife/Pine Point community gas service lateral.

2. Pipeline scraper traps and their associated components at compressor station locations.

3. Valve actuators for the mainline block and side valves at station locations.

In addition and although not within the scope of this panel, we are currently planning to install some piping and associated components above ground level at stations. The panel which will appear before this inquiry in the near future on the subject of station design will be available for further discussion in this area.

Several techniques which will be considered during the detail design phase will allow us to maintain design conditions during extreme ambient temperatures on above ground components. The design techniques will include the following:

1. Design for reduced pressure to give a stress level of less than 8,000 PSI when equipment or piping does not contain a flowing fluid to provide heat, blowdown condition.

2. Design for the minimum metal temperatures to be expected under the worst recorded atmospheric conditions in accordance with CSA Code Z-184-1973, paragraph 3.1.2.3 There are no recorded ambient temperatures lower than minus 75 degrees Fahrenheit in the vicinity of the proposed pipeline route.

3. Design for the minimum gas temperatures in areas such as blowdown systems where these are below the expected ambient temperatures.

At the locations where community lateral piping will be carried above ground on bridges, the piping will be suitably insulated to control hydrate

formation and will be designed in accordance with CSA Z-184-1973, paragraph 3.1.2.3b. The piping will be hung from bridge structural elements and supported on standard pipe hanger components. Precautions will be taken in designing the approaches to prevent thermal expansion and contraction from causing excessive stresses within the piping.

At scraper traps, the piping components which will be above ground would include a portion of the S-bend and all the reducers, scraper barrels, closer, kicker line, and drip leg connections and vents. No primary form of insulation or method of heating is proposed for the above ground components as the requirement for retaining heat is not necessary. The components will be coated with paint restricting any atmospheric corrosion and temporary localized heating may be provided by space heaters if and when the need arises. Scraper traps and associated pipeline components downstream of the trap valve will be maintained at pressures below 200 PSIG when not in operation. In addition, the scraper trap will not be allowed to operate or to be exposed to pipeline pressure at ambient temperatures below minus 50 degrees Fahrenheit.

The actuators for the large mainline valves will be sheltered in unheated buildings to prevent exposure to wind and blowing snow which could be detrimental to reliable operations. The actuators will be specified for ambient temperature operation which could be as low as minus 75 degrees Fahrenheit. In the event that difficulties are encountered with actuator

operations at extremely low ambient temperatures, then small infrared heaters may be installed within the buildings to apply concentrated heat to the actuator bodies.

Aside from the above ground piping and components mentioned in the preceeding paragraphs, it is our conviction that gas pipeline systems have historically been placed below grade and that the design of pipeline systems in such a manner is consistent with good operating integrity and the least environmental impact. Foothills recognizes that the design of a pipeline which will carry refrigerated gas through permafr ost will be different from previous conventional pipeline experience. On the other hand, we do feel that with the aid of geothermal models and site specific soil data, we can adequately understand the freeze and thaw phenonoma associated with permafrost. Suitable pipeline support design techniques will be applied to site specific situations which call for these techniques.

Although we do not foresee the installation of above ground piping where the pipeline runs overland, we are not discounting the possibility of installing overhead river crossings at specific locations where this is indicated to be preferable during the detailed design studies. It may be that we will propose one or two such overhead crossings where these might be desirable from an environmental point of view. At the present time, however, we do not foresee such a requirement.

Q Mr. Bauer you are the

Supervisor of Construction and Planning for Foothills Pipe Lines?

WITNESS BAUER:

A Yes.

Q Does the sheet attached to the prepared evidence and having your name at the top, accurately describe your academic qualifications and experience?

A Yes.

Q Would you read that into the record please?

A Education, Technische Hochschule University of Vienna, Austria, 1948, Mechanical Engineering, State Diploma.

Experience, Twenty-eight years of world-wide experience in hydro electric, oil and gas pipeline engineering, construction, management and consulting.

Austrian Federal RAilways, Hydroelectric Division, Villach and Innsbruck, Austria. Engineer on Planning, Economics. Design and Construction of Hydroelectric Projects.

B.C. International Engineering Co. Ltd., Vancouver, B.C. Canada. Alcan Project, Kemano, B.C. Canada. Chief Mechanical Inspector on Power plant and transmission line construction.

Goliad Oil and Gas Co. Ltd. Calgary, Pembina Field Project, Alberta. Project Engineer, responsible for engineering and construction of gas gathering pipelines and facilities.

Williams Brothers, Tulsa,

Oklahoma, U.S.A. Shell Oil of Venezuela, Punta Gorda Project, Venezuela. Supervising Project Engineer on oil pipelines, pumping stations, tank farms and deep sea loading facilities.

Sverdrup and Parcel Inc., St. Louis, Missouri U.S.A. Consultants to the Royal Irrigation Department, Bangkok, Thailand on the Phumiphol Hydro Electric Project. Tak, Thailand. Consultant responsible for all phases of mechanical installations.

Engaged by Bechtel Corporation, San Francisco, Calfornia, U.S.A. and affiliated companies over the period 1955 to 1967 on the following:

a) Trans Mountain Oil Pipeline Co. Ltd. B.C. and Alberta, Canada. REsident engineer on design and construction of pumping stations and pipeline looping.

b) Iran-Pan American Oil Company, Tehran Kharg Island, Iran. REsident Manager, responsible for direction of engineering and construction activities on oil processing plants, pipelines and loading facilities.

c) Burghausen-Pipelines Project (Transalpine Pipelines) Munich, Germany. Consultant, responsible for the acquisition of operating certificates. Director responsible for all phases of the project.

d) Savage River Mines Inc., Sidney, Melbourne, Tasmania Project Site, Australia and San Francisco, U.S.A Chief Project Co-ordinator, responsible for direction of all phases of engineering, construction and initial operation of plant, loading and

first solids (Slurry) Pipeline facilities.

Joined Foothills in November, 1974.

Professional Association, Member of the Engineering Institute of Canada. Member of the Canadian Society for Mechanical Engineering.

Q What type of problems were you faced with in designing the pipeline for Arctic conditions, Mr. Bauer?

A The basic approach to design taken by Foothills Pipe Lines has been to employ conventional pipeline design and construction techniques whereever conditions permit. Where conventional procedures were not suitable due to environmental or other site specific constraints, modifications to the conventional procedures were made, to overcome the constraints and still achieve the required quality. In all cases, the CSA Standard Z-184 will be complied with as a minimum and where special problems or unusual conditions are encountered, the special designs and procedures that have been developed are over and above the minimum code requirements.

Our fundamental design approach was first to define the major special problems of the north and then to develop a criteria for handling these problems and the design to set limits or values acceptable for the design criteria.

Two primary problems, those of permafrost and extreme cold, and one resulting problem of the effects of frost heave due to operation of the chilled gas pipeline required particular attention.

Early in the study of these particular problems it became evident that Arctic conditions, when left undisturbed are generally very stable and if this regime could be retained by appropriate pipeline design, the problems during and after construction would be minimized. Thus, our approach in setting our design criteria was to achieve a pipeline system designed to result to as close to undisturbed conditions as was practical and to still ensure that the operating system would be secure and functional.

Q Can you give an example of how you applied the approach?

A While the extreme cold of the Arctic has a major effect on anything exposed to ambient conditions, the effect of those ambient temperatures on a buried pipeline only causes minor differences when compared to a buried pipeline under southern ambient conditions. Arctic winter conditions tend to stabilize the permafrost ground regime which the pipeline is in. The swing into the summer season changes the permafrost ground regime in the active layer and the creation of this sometimes unstable active layer places restraints on the pipeline design, procedures and schedules.

One of the principal means of obtaining a secure pipeline is to develop a ditch design that will provide continuous support for the pipeline and a suitable protective cover over the line. To accomplish this, we paid particular attention to ditch design and established the construction procedure of pre-engineering the pipe into the ground. To meet the specific problem of the trench filling with blowing snow, we must minimize the time of open ditch exposure. This is accomplished by altering the conventional procedure of opening the ditch and then bending the pipe to conform to the ditch. Rather, we would establish the ditch bottom contour and provide it to the pipe bending crews so that the pipe configuration can be established ahead of the ditching operation. The pipe will thus conform to the finished ditch when it is completed later. Following established construction practices, the ditch

excavation, bedding, padding and backfill requirements would be completed to the specifications required for the area. This will be accomplished through applying known data or assumed data on ground conditions, subject to further confirmation during final design of geotechnical analysis and then predicting the soil behaviour.

The specific design of the ditch configuration will include consideration of extra depth ditch that may be required to ensure that frozen conditions exist at pipe depths in areas that might be susceptible to ditch flooding during the summer time in the pre-operational phase of the pipeline.

Q You have mentioned bedding, padding and backfill; can you explain their uses, please?

A The specifications for ditch configuration and backfill requirements will include consideration for the need to support the pipe to overcome vertical, longitudinal and lateral movements that could occur along the line and particularly at bends.

A preliminary analysis of the native materials expected to be excavated from the trench will be determined during the design phase and, subject to confirmation during installation, will be used to establish the extent of select bedding, padding and select backfill materials required.

Bedding is required to assure continuous longitudinal support of the pipe where the ditch bottom is irregular in shape and to prevent damage

to the pipe coating through contact with bedrock, frozen soil, cobbles or other hard materials. Where the ditch is in unfrozen soils, and has a smooth bottom and where no cobbles or rocks exist, a bedding layer will not be required. When bedding is required, then it will be obtained from borrow sources.

Prior to laying the pipe, the natural soil or the bedding will be contoured to the radius of the pipe to produce a minimum 30 degree bedding angle. Where a bedding layer is required, it will be a fine granular material and will be compacted.

Paddding is generally obtained from select excavated material or from borrow material for the purpose of providing a protective layer around the pipe. Padding will be compacted to eliminate large voids and additional compaction of padding will be required at the following locations: sidebends, overbends, below ground to above ground transitions and block valves. The function of the padding for each of these is as follows:

(a) Sidebends: Padding acts as a uniform bearing surface to transfer the pipe loading to the surrounding soil and minimizes movement of the pipe due to pressure and temperature.

(b) Overbends: padding acts as a uniform bearing surface to transfer the pipe loading to the overburden material and minimizes movement of the pipe due to pressure and temperature.

(c) Below ground to above-ground transitions: Padding provides additional

frictional resistance to pipe movement due to temperature in the longitudinal direction.

(d) Block Valves; padding provides complete support of the pipe on each side of the block valve to minimize the transfer of stresses from the pipeline to the valve body.

The backfill material will provide protection to the pipe, restore the ground surface and act as an overburden load for pipe restraint in both longitudinal and vertical directions. Backfill will normally be obtained from the excavated material. If the native excavated material is unsuitable with respect to stability, consolidation or erosion control, then borrow material will be used for select backfill.

Q What is your approach towards handling potential frost heave areas?

A The problem of frost heave that could occur where the chilled gas pipeline would go through areas of unfrozen soil, required consideration in ditch design configuration. While the question of frost heave and its control will principally be handled by the geotechnical witnesses, some comment of its effect on ditch configuration design will be made here. Again Foothills adheres to common practice and procedures as far as possible. Based on preliminary geotechnical assessments, with confirmed data to be obtained before final design, ditch specifications would be developed to meet the various requirements for frost heave control. These would provide for excavating extra depth ditch, removing the frost susceptible material and

replacing it with select material.

In summary, a ditch specification would be established for the varous conditions of permafrost, potential frost heave and normal soil. The ditch specification would, of course, also reflect considerable input relative to cross drainage requirements, erosion control, revegetation, replacement of top soils, permit crossing requirements and slope stabilization, both across and along the pipeline, to the extent determined necessary in the final design.

Q Mr. Walker, you are the president of Canuck Engineering of Calgary, Alberta?

WITNESS WALKER:
A Yes.
Q Does the sheet attached to the prepared evidence and having your name at the top, accurately describe your academic qualifications and experience?

A It does.

Q WOuld you read the contents of that sheet, please?

A Education, Bachelor of Science Degree in Civil Engineering, University of Alberta, 1949, Edmonton, Alberta; Banff School of Advanced Management 1964.

Experience: 26 years experience in oil and natural gas pipeline engineering, operations, construction and management.

1949-1953: Interprovincial Pipe Lines Ltd., Edmonton, Alberta. Engineer on economics, planning, hydraulics and pipeline and pump station

design, construction and operation of Canada's largest oil pipeline.

1953-1961: Mannix Company Limited, Calgary, Alberta. Manager, Pipeline Division of one of Canada's largest contracting companies, responsible for pipeline and petroleum engineering and construction.

1961-1971: Alberta Gas Trunk Line Company Limited, Calgary, Alberta. Vice-President, Engineering, and Vice-President, Operations, in charge of company's total engineering and operations.

1971-1974: Canadian Arctic Gas Study Group Limited, Calgary, Alberta. Director of Engineering, responsible for all phases of engineering and initial environmental studies for Arctic Gas pipeline project development.

1974-Present: Canuck Engineering Limited, Calgary, Alberta. President, responsible for direction of engineering and construction departments.

Professional associations, past and present: President of the Pipeline Contractors Association of Canada; Member of the Canadian Petroleum Association, Pipeline Committee; Chairman of the Canadian Gas Association Transmission Committee and Member of the Board of Directors; Vice-Chairman and member of the International Gas Union Transmission Committee; Registered Professional Engineer in Alberta.

Q And Mr. Walker, it's in connection with the International Gas Union Transmission

Committee that you have some familiarity with Russian operating procedures?

A Yes, I have some.

Q And have seen those in Russia?

A That is correct.

Q Mr. Walker, what factors have you considered in your river crossing designs? Which of these are principal factors and how have you applied those factors to the river crossing design?

A River crossing design incorporates dat a and information provided by several engineering sciences such as hydrological and hydraulic studies that will give information on river bed degradat-ion, potential bed scour, course stability, icing effects, seasonal floods, surface and sub-surface drain-age and any effects storms could have on the water levels. Geotechnical and surficial geology expertise will also be used to provide data on river valley and stream bed soil characteristics, bank stability and potential for erosion and extent of permafrost and/or frost bulb growth effects. Other engineering disciplines, including metallurgy, stress analysis, corrosion pro-tection, environmental assessments, mechanical and civil engineering, pertaining to weighting, construction techniques, excavation, trench back-filling and bank restoration and stabilization will be utilized to com-plete the designs.

The principal factors will include the predicted hydraulic performance of the river

and the geotechnical assessments of the stability of the river banks and stream bed characteristics. All of these factors have been taken into account in the river crossing designs by obtaining, at this state of the project development, preliminary assessments from experts in these fields and applying this information to develop a "river channel envelope" that would include all areas of potential stream bed changes and river bank instability. The pipe location was then established an additional distance beyond the outer limits of the river channel envelope of potential stream channel change or disturbance. In some cases where bank instability could not be controlled, alternative designs to control the bank movements will be included and the envelope of disturbance reduced accordingly.

Having established a secure location for the pipeline outside of any area of potential disturbance due to shifts in the river or its banks, engineering calculations were performed to achieve a pipe configuration within allowable stress levels and weighted to provide a selected negative buoyancy for the specific river crossing.

Q How do you know that this will work and can you outline the construction procedures to achieve such crossing designs?

A The designs completed to date are based on initial data on the river behaviour, sub-surface and bank conditions. Before final designs are completed, extensive field investigations and further studies will be made to determine the hydraulic behaviour

and geotechnical conditions as confirmed data, and this will be used in the final pipeline crossing designs. With confirmation that the location of the pipe in the river crossing will be in stable ground and will not be disturbed over the forecasted life of the project, and by developing designs well within the code requirements for the Arctic, we can be sure of the security and stability of the pipeline crossing.

The construction procedures to achieve the detailed final designs will depend on the specific design, river crossing conditions and selected construction seasons. For example, the main East Channel crossing of the Mackenzie River near Swimming Point which has a silty and sandy bottom will be constructed in summer by welding up sections of pipe on a pad to be deposited on the one bank by dredging materia from the river channel trench area. The trench in the channel itself will be excavated by a suction dredge with the hydraulic spoil deposited on both banks as required to build up the required work and pull areas and for use as selected back-fill. The sections of concrete coated pipe will be pulled by cable into the channel trench and additional sections welded into the full section as required until the channel crossing was completed. Hydraulic dredging again will be utilized to backfill the bottom portion of the trench, generally obtaining the spoil from a downstream location. The shore section of the trench will be backfilled using the hydraulicked spoil obtained from the original excavation. However, basically the work pads will be left in place to serve as future storage areas for mainline construction requirements.

The Fort Simpson crossing of the Mackenzie River where the channel contains substantial cobbles and boulders will probably require a combination of dredging and dragline operations, working from a barge in the summer and using a graded or gravel fill pad and then following similar procedures as outlined for the East

Channel crossing.

Smaller river crossings will generally be constructed in the winter time working through the ice with the trench excavated by backhoe or dragline and the excavated material bulldozed away from the active channel area and stored on sections of the ice where the ice is either fast or close to resting on the bottom. The pipe for these crossings in general will be layed across the ice, weighted (if not pre-concrete coated) and lowered into the trench by use of side booms. The back-fill material will then be broken up and dozed back into the river trench.

Q Would you explain your design rationale for selection of single rather than dual river crossings?

A The Applicant has based its design on selection of the most economical pipeline system that meets the necessary criteria for security and continuity of service consistent with acceptable minimum environmental, sociological and other judged impacts. Hence the benefits in-cluding security and future use of a more expensive dual pipeline crossing had to be measured against its increased cost before a dual river crossing design would be adopted. Based on the forecasted future use and initial crossing data available, our assessments did not justify the increased cost of dual crossings at this time.

The approach by Foothills Pipe Lines Limited on the river crossing design was to accept only a crossing design that would be assessed

as secure. If any assessments challenged the security of the crossing design, the crossing design was revised, relocated or redesigned to ensure a safe crossing rather than taking a dual crossing design approach for the purpose of increasing system security. The philosophy of achieving one secure pipeline river crossing was preferred to accepting a philosophy of potential failure in river crossing designs This approach does not, however, rule out having available operations and maintenance contingency plans for emergency repairs or replacements that would be adopted regardless of the philosophy chosen on single or dual river crossing designs.

MR. GIBBS: Mr. Walker, in the assembly, we seem to have gotten questions 19 and 20 interchanged. Does 19 now fit sensibly into your narrative? At this stage, that is.

A The evidence that I gave just ahead of -- there should be some comments inserted just ahead of 20, on pressure testing on construction procedures.

Q Would you then --

A I'll be glad to make those comments now.

This is further to your question, how do you know that this will work and how can you outline the construction procedures to achieve such crossing design. Further on, in response to that question, pressure tests in the pipeline section, and tests on the completed crossing, would be made separately to ensure the integrity of the crossing. Close inspection

of the required depth of excavation, placement of the pipe and back filling procedures would be maintained, to ensure compliance with the drawings and specifications. The final pigging of the crossing, with a gauging or smart pig will be performed to ensure there are no buckles, dents or obstructions on the final crossing. Bank restoration, armouring and revegetation as specified, would be completed as soon after construction as seasonal conditions would permit .

Q Can you now comment on river crossing problems of other pipelines and how will the Foothills design overcome those problems?

A Pipelines have had a relatively good record from a safety and security point and considering the large number and length of service of pipeline systems in Canada, there have been few failures. In general, the causes for these failures were due to unpredicted behaviour of the rivers or a failure by the designer to have fully assessed the potential for the behaviour of the rivers and the stability of its banks. Had full utilization been made of today's state of the art available to us of river engineering, geological and geotechnical sciences, river crossing designs in general, would, in my opinion, have placed the line safely below the areas of river bed and bank disturbance that caused pipeline river crossing failures or wash-out.

The Foothills river crossing designs will fully utilize the expertise available in these fields and be based on thorough site and river regime studies, so that the crossing designs will be as

secure as these engineering practices can make them. In addition, complete utilization of site data assessments will be made of the potential dangers due to acts of man, such as barging anchoring in the channel, and allowance included in the design, if necessary, to protect against such a possibility.

Q Dr. Glockner, you are a consultant with Foothills Pipe Lines Ltd.?

DR. GLOCKNER
A Yes.

Q Does the sheet attached to the prepared evidence and having your name at the top accurately describe your academic qualifications and experience?

A It is an accurate short condensation of parts of my curriculam vitae. I would like to add some small changes in addition, if they're appropriate.

Q All right, would you read it in making the changes that you wish to make.

A Education, Bacheler of Engineering with Honours in Applied Mechanics at McGill University, 1955.

Master of Science in Civil Engineering, Specializing in Structural Engineering, at the Massachusetts Institute of Technology, 1956.

PhD in Civil Engineering, University of Michigan, 1964.

Experience, Assistant Professor University of Alberta, 1958 to 1960.

Assistant Professor at the

University of Calgary, 1960 to 1962.

Associate Professor at the University of Calgary, 1962 to 1968.

Professor of Civil Engineering, since 1968 at the University of Calgary.

Design Engineer with C.C. Parker, Whittaker and Company Limited, Structural Consultants in Edmonton, Alberta, 1956 to 1958.

Various consulting work with consulting firms in Calgary, Edmonton and Southern Alberta, from 1958 through 1975.

Professional Associations, Past and present.

American Society for Civil Engineers, American Concrete Institute (ACI), American Academy of Mechanics, where I was also member of the Board of Directors, International Association for Shell and Spatial Structures (IASS) where I'm also currently a member of the Executive Council from Canada.

International Association for Bridge and Structural Engineering, for which I was also the chairman of the Canadian group, for three years.

Member of the Canadian Executive of the Institute of International Union of Theoretical and Applied Mechanics.

American Hungarian Literary Guild.

Society for Applied Mathematics and Mechanics, it's written here in German, Gesellschaft fur Angewandte Mathematik und Mechanik.

Engineering Insitute of Canada.

Canadian Society for Mechanical Engineering, I'm the chairman of the local group in Calgary at the present time.

Canadian Society for Civil Engineering, Division of Mechanics and Applied Mathematics (CSME) for which I'm a member of the national executive.

I am of course a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta, and a member of the Calgary FAculty Association of University Teachers, as well as that of the Canadian University Teachers.

Q Dr. Glocker what causes and effects did you take into account relating to the structural integrity of the pipeline?

A A high pressure gas transmission pipeline is a straight or curved cylindrical shell structure. As such, it is subjected to stresses due to internal presure as well as longitudinal and circumferential stresses due to movements which the pipeline will undergo. Stresses are also caused by temperature and pressure changes in the pipeline.

Due to the Arctic conditions, which are encountered along northern segments of the proposed pipeline route, special care is taken in the analysis to evaluate the stresses and strains in the pipeline due to these various causes in an attempt to predict its behaviour under the diverse conditions which it will be subjected during its operational lifetime.

Foothills is using the well established principle in pipeline design and construction of assuming the buried straight pipeline as being "constrained" against longitudinal movement.

This means that the pipe , as long as it is straight and buried, will not be subject to any longitudinal movement, due to temperature changes and various other causes. Naturally where the alignment dictates a vertical or horizontal bend in the pipe, the assumption of complete constraint has to be relinquished and the design has to take into account the longitudinal stresses produced by temperature changes, by circumferential hoop stress as well as by the relative movements of segments of the pipe.

The following causes have been taken into account in stress analysis of the pipeline structure.

1) Circumferential stress due to internal pressure. This stress level is kept below the maximum allowable hoop stress as given by the Code and also as dictated by extended use criteria for the type of material out of which the pipeline will be constructed.

Number 2: Longitudinal stresses due to internal pressure.

Number 3: Longitudinal stresses due to expected maximum temperature changes. Since along many sections of the pipeline installation will occur during winter months and since the proposed operational temperature of the pipeline is, in some cases, well above the freezing point, the temperature increment which the pipeline will be subjected to from the time of installation to the time of operation, will cause severe longitudinal stresses. As long as the pipeline is straight and buried, the longitudinal stresses are of no major concern provided the stress level is kept below the allowable. In curved portions of the pipeline, temperature changes cause significant bending moments which have to be accounted for in arriving at the total longitudinal stress state.

Number 4: Bending stresses and deformations due to frost heaving. Along certain segments of the pipeline, where sufficient moisture is present in permeable soil and the operating temperature is below freezing point, geothermal calculations show that ice lenses will form and those underneath the pipe result in upward frost heave pressures on the pipeline. The upward tendency of movement of the pipe will be resisted firstly by the overburden, secondly by the shear strength of the soil which the pipe is tending to push up, and finally by the flexural rigidity of the pipeline.

Number 5: Settlement stresses.

The pipeline may be left unsupported where the supporting soil consolidates or settles due to thawing of the ice in the soil. In these situations, the pipe will have to span such settlement areas carrying the weight of the overburden soil. The distance of the unsupported spans will depend on the height and density of the material above the pipe as well as the magnitude of allowable soil pressure and distribution of this pressure adjacent to the settlement area which is affecting the pipeline.

Number 6: Along sections of the pipeline where vertical or horizontal bends are required, temperature changes will cause movements of the pipeline which will be partially resisted by the passive earth pressure of the surrounding soil. The displacements in such bends, the minimum permissible radii of curvatures and possible additional support or anchors required, are all factors which are determined by the analysis so as to keep the state of stress in the pipeline within the safe, permitted level.

Number 7: There will be certain sections of the pipeline along which the pipe will cross muskeg so as to be surrounded at times by a fluid medium. In such instances the density --

THE COMMISSIONER: Fxcuse me. "So as to be surrounded at times by a fluid -- "

A By a fluidmedium

THE COMMISSIONER: You mean by water?

A Water or a mixture, Mr. Commissioner, of soil and water, which has zero

shear strength.

In such instances, the density of the liquid is higher than the overall average density of the gas-filled pipeline and therefore upward buoyancy pressures tend to lift the pipeline above the water or muskeg. Analyses are performed to determine the saddle weight spacing, the maximum flexural stresses due to such upward pressures and the displacements accompanying these stresses.

In addition, these areas, the pipe is of course completely unconstrained and therefore the differences in longitudinal stress between the constrained and unconstrained segments have to be taken into account in the analysis. Temperature changes will, in some cases, cause large compressor stresses in the pipe which demand an overall stability analysis on the floating pipeline.

Number 8: Additional circumferential and longitudinal stresses due to radial as well as axial temperature gradients are also taken into account in the design.

Q How much horizontal and vertical movement can the pipe tolerate, based on your calculations, and how reliable is the data?

A Corresponding to the class location of the proposed pipeline route, the C.S.A. specification Z 184-1973 allows a maximum move stress of 80 percent of the specified minimum yield strength, S.M.Y.S. The pipeline operation pressure is set at 1,250 PSIG which corresponds to a stress level

of 69 percent of S.M.Y.S. The expected maximum temperature changes estimated on the basis of possible minimum insulation temperatures and proposed operating temperatures will produce axial stresses. Longitudinal stresses will also be present due to the hoop stress.

Bending of the pipe, whether it is in the vertical or lateral direction, produces longitudinal flexural stresses. The sum of these longitudinal stresses also has to be kept below a certain level. In addition to these stress and failure limitations, the designer needs to concern himself with overall stability and local buckling and wrinkling of the pipe. Tests and theoretical calculations indicate that longitudinal strain levels of the order of 1 percent are usually present when local wrinkling or buckling occurs in pipes which have diameter to thickness ratios of the same order of magnitude as that of the pipe to be used in the proposed pipeline. For this reason, maximum strain levels are kept well below this 1 percent figure; in fact maximum strain levels are established at half a percent. It is important to note that half a percent strain is also the specified yield strain for the material of the pipeline, therefore as long as strains are kept below one half percent, the material behaviour will be approximately linear.

In view of all these restrictions and constraints, calculations have been performed on segments of pipeline treating them as slender, straight or curved beams and/or beam-columns and subjected to various distributed loading conditions in accordance with

the above described causes. Naturally, the magnitude of permissible displacement depends on the length of the pipe involved. The longer the pipe segment which undergoes bending, the larger the displacement which can be tolerated.

Mr. Commissioner, although I call for a slide just a few lines further down, it might be helpful if we were to put the first slide on here now. Perhaps we can just look at that for a minute, and I think it is better if I go up to the slide.

Well what we are trying to indicate on this slide, sir, is deflection with allowable span, keeping in mind what I just read into the record a few minutes ago, that we are keeping deflections within allowable limits. By that, we mean that the bending associated with these deflections will have to be kept within these allowable limits. On the ordinate here we see deflection "C" and is the allowable span.

We have shown here the deflection versus the span for a simple structure such as this, which actually models a piece of a pipeline, if you think in terms of a long pipeline which is twice as long as this piece here and if you were to force a displacement laterally or vertically on the pipe of an amount Delta which we designated as deflection, then the deflection corresponding to a bending moment produced in a total length of so many feet is given on this graph and is given by this red curve here sir.

For example, on a 200 foot span, we can tolerate roughly a deflection of two feet.

THE COMMISSIONER: Thank you.

MR. GIBBS: Perhaps while we are having the lights up, sir, we might mark the photographs of that slide as exhibit 239.

THE COMMISSIONER: Certainly.

(PHOTOGRAPHS OF SLIDE MARKED AS EXHIBIT NUMBER 239)

MR. GIBBS:

Q Continue, Dr. Glockner.

A In all instances, however, the maximum bending moment due to such bending action was limited to 20 percent of the yield moment, i.e. one-fifth of that value of bending moment which would cause yielding on the outer fibre of the pipeline, which is the most highly stressed portion of the pipeline. It should be recognized that the limits of displacement which are indicated on the exhibit titled "Allowable Spans for Elastic Deflection" are not the kind of displacements that would produce fracture in the pipeline. If one permits yielding not only in the extreme fibres but in sections of the pipeline closer to the neutral axis of bending, then substantially larger rotations and correspondingly larger displacements can be tolerated by the pipeline.

The calculations, of course, are also based on certain assumed loading conditions which are felt to be a reasonable first approximation of the actual state of stress at the soil/pipe interface. All such loads are assumed to be loads acting on the pipeline in its normal operational state so as to eliminate the necessity of getting involved in the nonlinear load deformation behaviour of the soil surrounding the pipeline. Finally, all calculations are based on assuming that both pipe material and the soil have a unique stress strain curve so as to guarantee a unique final displacement irrespective of the order in which the total load was applied or came to be acting on the pipeline.

The reliability of these predicted maximum possible displacements depends, of course, on the degree to which the specified minimum strength properties of the materials and assumed loading conditions differ from the actual properties of the materials involved and the actual forces acting at the soil/pipe interface. The material properties and load distributions assumed in this analysis are consistent with the data obtained from the initial field investigation. Data from detailed field tests will be utilized in the final design process.

Q Can you explain how your work has been related to various pipe/soil interface conditions, especially with respect to variations such as frozen ground and unfrozen swamp?

A As stated in my reply to question 1, two of the causes that were taken into

account in analyzing the pipeline as a circular cylindrical structure, were the movements expected in the pipeline due to frost heave and settlement due to melting of ice lenses, as well as buoyancy effects in swamps.

In the case of frost heave, the pipeline is assumed to be a straight or curved slender beam fixed at its two extremities against lateral and longitudinal movement. Due to the frost heave, it is subjected to certain upward forces. At the same time the upward movement tendency is counterbalanced by the weight of the overburden soil as well as the shear resistance of the soil along potential planes of shear between the soil block which the pipe is trying to dislocate upwards and the surrounding soil section. The weight of the soil can be estimated fairly accurately but the shear resistance of the various types of soils encountered along the pipeline load carry over a large range and therefore, in order to be conservative, the lower limit of this range was assumed to be zero.

Any remaining upward unbalanced forces, of course, have to be resisted by the pipeline as a beam in bending, thus producing bending moments and flexural stresses in the pipeline. The maximum permissible upward deflections, which would produce bending moments in the pipeline equal to 20 percent of the yield moment for various assumed pipeline segments are given in the exhibits titled "Frost Heave Loading Configuration" and "Allowable Deflections Due to Frost Heave".

Here again, sir, we will have to use a few slides.

Q The slides are what you refer to, Dr. Glockner, as exhibits in your text?

A Yes.

This first slide, sir, tries to indicate the frost heave loading configuration, that is the type of loads which are acting on the piece of pipeline when there is frost heaves taking place. This is the over all effective span L over which this pipeline is trying to resist the action of frost heave. We assume that the two ends, the two extremities of this piece of pipe are being constrained against lateral and longitudinal movements. Because of this constraint of course we have some forces of the action here, sheared and bending moments, weakened ends.

All of these are caused by this upward frost heave pressure which we assume to be acting over a portion of the span designated by alpha L as a heave span.

This upward pressure and upward motion, or tendency to move upwards, is counterbalanced, as I said a minute ago, partly by the weight of the overburden the soil above, the shear resistance of the soil which the pipe will try to push upwards, as well as the flexural rigidity, flexural bending action of the pipe itself.

We designate, sir, the weight of the soil and the shear resistance of the which the pipe is trying to push upwards, as ASW-I.

the soil resistance in so many kips per foot on some following slides, and we designate the upward pressure due to frost W-2 kips per foot.

We have assumed this upward frost heave pressure as a uniform pressure in these calculations. Also, of course the weight of the soil and the shear resistance are assumed to be uniform load.

Based on standard calculations, one can calculate the kinds of deflections this pipe can undergo, subjected to these loading configurations, such that the stresses due to bending in the pipe at no point shall exceed 20 percent of the yield moment, and on the next couple of slides we are trying to show some of the results of these calculations.

Can we have the next slide?

MR. GIBBS: Might the one which Dr. Glockner has just referred to be marked as Exhibit 240, sir?

(FROST HEAVE LOADING CONFIGURATION MARKED AS EXHIBIT 240)

WITNESS GLOCKNER:

A On this slide then we are showing the allowable deflections due to frost heave. We find the ratio of W-2/W-I, that means the frost heave pressure to the overburden pressure in kips per foot as a ratio.

THE COMMISSIONER: In what per foot?

A KIPS that's a thousand pounds sir, kips per foot, and along the assista we are giving the ratio of this maximum deflection which can produce such bending strengths to the overall span so that we are giving non-dimensional quanties here in the slide.

This whole graph , sir, is applicable to an assumed value of the overburden equals one kips per foot, that is one thousand pounds per square foot, and then we have several graphs here, varying the length of the frost heave that is varying the percentage over which the frost would be acting on the whole span /for example, Alpha equals point I we are assuming that frost pressure over I0% of the total span. Similarly Alpha equals 0.2, 20%. 0.3 and 0.4. Then in these curves then we can read off the deflection if you are kind enough to specify a given length for me, the deflection which will produce these bending pressures for a given ratio W-2 over W-I, in other words the curves contain quite a lot of information.

The next diagram shows a similar set of curves for a different value of the overburden, W-I equals 3 kips per foot and again you can see the same trends of these curves granted it is noteworthy that, naturally with higher upward pressures, higher frost action. The deflection of the span ratio has decreased, in other words we can't follow it has as much deflecti on as the load deflection.

MR. GIBBS: Might those two be marked, sir, Exhibits 241 and 242?

THE COMMISSIONER: Yes.

(ALLOWABLE DEFLECTIONS DUE TO FROST HEAVE MARKED AS EXHIBIT 241)

(ALLOWABLE DEFLECTIONS DUE TO FROST HEAVE-FROST HEAVE TO ALLOWABLE SPAN RATIO MARKED AS EXHIBIT 242)

DR. GLOCKNER:

A A further problem related to ice lenses, which is attributed to the melting of these ice formations, is the settlement of the supporting soil under a certain length of the pipeline. In such instances, the pipeline will have to span over the settlement area and carry the weight of the overburden, together with its own weight as a beam. The length of such soil settlements over which the pipeline can safely span, as previously mentioned, depends not only on the amount of overburden and its density but also on the soil bearing pressures which are acting on the pipeline

adjacent to the settled areas as well as the distribution of such pressures along the pipeline. Results from these calculations are indicated in the exhibits titled "Settlement Loading Configuration" and "Allowable Deflections Due to Soil Settlement".

I wonder if we could have the next slide. This is a bit dark, I hope everyone can see it. What we try to indicate here, sir, is that the forces are acting again on the typical length of pipe when such a settlement occurs. Again, the effective pipeline span is indicated by "L" We assume the two ends of this span will be fixed against longitudinal and lateral displacement and of course again we have forces that are shear acting at those positions as the action.

The load that is acting on this pipe segment now consists of some overburden pressure, that is the weight of the pipe as well as the soil above it, which the pipe will have to carry over this portion where the soil below the pipe has settled if you like, or for some reason disappeared. Adjacent to that wash-out, or whatever caused this disappearance of soil, adjacent to this of course the soil will have to carry some of this load, in fact it will have to carry some additiona l load.

The pressure distributions adjacent to the soil wash-out areas, or areas in which the pipe will have to bend, are assumed to be triangular, varying from maximum values of W2 to zero at some distance alpha 2 L away from the actual washout The distance over which this pipe has to span is designated by Alpha I L, a certain percentage again of the total span. As the previous slide W-I represents the total overburden weight, the weight of the pipe and the weight of the soil above it.

This assumes load configuration and again limiting the maximum bending on the span anywhere to 20% at yield moment so that the stress will be only 20% of the yield stresses, we can arrive at certain curves again where we've got ratio of W-2 to W, and again we have got maximum deflection of the whole span which will produce such maximum stresses, allowable maximum stresses.

We could maybe have a look at the next slide to see such results. On this slide, again the ratio of W-2 to W-I,this time the soil reaction, maximum soilreaction pressure to the overburden pressure and the allowable deflection to span ratio Delta over L. We have several families of curves here, sir, on this graph corresponding to various values of AlphaI, that means various assumed percentages of the wash-out. For example in this set of curves we assume Alpha I equal to point I. In this set of curves we assume Alpha I equal to point 2 and this set of curves here we assume Alpha, equal to point 4 so we increase the length over which the pipe has

to span as we go from here to here. In addition to that it will be noted there was another variable which we can vary, namely the length of resistance soil block adjacent to the wash-out area, that is designated by Alpha 2 of L and therefore we have several curves within each family for Alpha 2 varying from point I to point 2. We are saying here, for example in this particular curve that the wash-out in the middle of the span 40% of the length of the pipe and the length over which the soil is resisting adjacent to this wash-out is I0% of the span. Those configurations and loads on the pipe we get this curve here giving us W-2/W-I verses allowable deflection to span ratio and similarly all other curves.

I should mention that this whole graph is drawn for value of W_I is equal to I and one can generate similar curves and we have generated similar curves with other values of W-1. The value of W-2 of course is varied along this curve here

MR. GIBBS: Could the last two be marked Exhibit 243 and 244

(SETTLEMENT LOADING CONFIGURATION MARKED AS EXHIBIT 243)

(ALLOWABLE DEFLECTIONS DUE TO SOIL SETTLEMENT MARKED AS EXHIBIT 244)

MR. GIBBS: Would you continue Dr. Glockner.

A Along certain sections of the pipeline route. muskeg and various slough areas are encountered, in which the pipe will be surrounded by a fuid medium of zero shear strength. Not only does the pipeline lose its restraint, but also because the overall density of the pipeline with its gas content is less, than that of the surrounding liquids. upward buoyancy pressures tend to lift the pipeline to the surface of the fluids. In such situations, two problems must be addressed.

The question of lack of longitudina constraint and the difference in longitudinal stresses between the constraint buried pipe and the non constrained floating pipe is one important aspect of the design. In these muskeg or slough areas in the southern regions. the pipe would be installed during the winter months. Therefore, under the proposed operating conditions, there will be large increase in temperature, which results in substantial longitudinal stresses in the pipe. In the case of a straight pipeline such stresses bring about

the necessity of considering the overall stability of the pipe. In the case of curved portions such temperatures effects produce additional flexural stresses. Stability analysis of the pipe indicates that the proposed spacing of saddle/weights used to keep the pipeline under the liquids is smaller by a factor of ten, than the critical free length of the pipeline at which overall instability would occur.

Number two, the uplift due to buoyancy has to be counteracted by saddleweights It is proposed that saddle/weights spaced at designed intervals will be used to overcome the buoyancy forces. These saddleweights and buoyancy pressures result in flexural deformations and longitudinal bending stresses in the pipe. However, as long as the saddleweight elevations are approximately equal, these stresses are relatively small and amount to only approximately one percent of the allowable longitudinal stress in the pipe.

MR. GIBBS: This panel is now available for cross-examination.

THE COMMISSIONER: Thank you, we'll adjourn for a few minutes for coffee now then.

(PROCEEDINGS ADJOURNED)

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

CROSS-EXAMINATION BY MR. MARSHALL:

Q Dr. Glockner, could you have in front of you Exhibits 240 and Exhibit 241, the first being the diagram of frost heave loading configuration, the second being the allowable deflections due to frost heave.

A Yes.

Q I'd like to work through an example with you of the application of your formula. We could start with L which is as I take it from the Exhibit 240, the effective pipeline stand. Could we assume a length of 200 feet, would that be reasonable?

A Yes.

Q And then the next item would be the heave span or described as Alpha L. Would it be reasonable to assume a value say of 40 feet, roughly scaling your diagram here, if we have 200 for L, Alpha L at 40 feet?

A Yes.

Q And Alpha would therefore be decimal two?

A That is correct.

Q The next component would be the soil resistance, W-1. Could we assume the value shown on Exhibit 241, which would be one kip per foot, 1.0K/FT as you indicated there, right?

A Yes.

Q That's an overburdened pressure then of 1,000 pounds per foot?

A That's correct.

Q Now then, W-2. which is the heave pressure, I would ask you to assume 6.68 kips per foot, would that be a reasonable value to assume in such an example?

A I assume you have some reasons for assuming 6.68.

Q Well it fits conveniently on your scale.

A I beg your pardon?

Q It would fit conveniently on your scale about a third of the way up.

A That's fine, you can pick any number whatsoever.

Q I'm still at a bit of a disadvantage here, but I understand that's a reasonable figure to -- I'm told it's a good figure.

Then if we go to Exhibit Number 241, we go up the left hand side, to 6.68. about a third of the way up. We translate that, we carry that point across onto your green curve which is Alpha 0.2, which gives our assumption.

A Yes.

Q Then following that down to the base line, we end up with a value, as I understand it of about 11.3. Are we together?

A Well it's difficult for me to sir to extrapolate these curves. I would have to have a set square, but I would take your word for that 11.3, it doesn't matter.

Q Take 11.

A Eleven, yes.

Q Really, if you took 11.3 the rest of my figures might work out.

Then Delta over L would be 11.3 over 10,000 and working that through your formula, my instructions are that we end up with a value for Delta of .226 feet. I'm sure it's much easier for you to go through that then for me. Is that how it works out?

A It's 11.3 times 10 to the minus 4, which is equal to Delta over L, and therefore Delta would be equal to 11.3 times 10 to the minus 4, multiplied by 200, and multiplied by 12 if you want to have it in inches and now I wish I had brought my slide rule and my calculator along with me.

THE COMMISSIONER: Dr. Glockner, would you mind just running through those figures again.

A Well I was just writing this down so I can get the numbers here, that the counsel has asked me. 11.3 --

MR. MARSHALL:

Q I understand it's 2.71 inches. Dr. Clark has worked it out.

A Well I believe him. But let me just do it myself okay, just to make sure. I usually trust my calculations when I do them twice. 11.3 -- I guess I have to find out how to operate this machine. 11.3 times 10 to the minus 4. Now there's another problem you get in this one. Multiplied by 200

first equals -- all right, that sounds reasonable. Multiplied by 12, -- no, it's no good.

THE COMMISSIONER: I don't know how much longer we are going to go on.

MR. MARSHALL: I know I won't last much longer sir.

WITNESS GLOCKNER·

A What did you get, Mr. Clark , for the answer? .27 inches. 2.7 inches.

MR. MARSHALL:

Q About 2.7 inches.

A Fine.

Q I take it then that the allowable deflections due to frost heave over this 200 foot span that we're analyzing would then be something under three inches?

A This is correct. This is a deflection which would cause bending stresses, FLEXURAL stresses in the extreme fibre of the pipe, equal to 20 percent of the yield moment,

Q Well sir, have you applied this theory to any specific operational pipeline?

A What theory?

Q Your criteria as set out in Exhibits 240 and 241.

A Well, I think that the deflections which are calculated here apply to any pipeline. This pipeline is just circular cylindrical structure.

and we have got certain assumed loading conditions on it and we calculate its displacements, for given spans which will cause 20 percent of the yield moment at the maximum bending moment sections which is either at the end of the span or in the middle of the span.

Q Have you checked this against what is happening in any pipeline that is installed and in operation?

A You mean the deflections?

Q Yes.

A I haven't checked these against any pipeline which is installed, no.

As far as I know, sir, there hasn't been any pipelines constructed in the northern climates where oné could observe these frost heaves very well.

Q Have you --

THE COMMISSIONER: Just the thing at Calgary?

A I beg your pardon?

THE COMMISSIONER: Just the test site at Calgary. I don't know if you could check it against that.

A Well it would be very difficult to reproduce the frost heave conditions, sir.

THE COMMISSIONER: But they have sought to do so at the University of Calgary, haven't they? There's a frost heave test site there, however that's irrelevant.

A Yes, there are some frost heave test sites on the pavement, as I understand it. Is that the one we are talking about?

MR. MARSHALL: It's a site near the University of Calgary.

A I'm not familiar with that, sir.

MR. MARSHALL:

Q Sir, could you tell me how pipeliners would be expected to keep the deflections within the limit as in this example we would come out with less than three inches? Do you establish criteria

for that?

A Well, first of all, the three inches I think came out -- are you thinking that the deflection of three inches is perhaps small for a frost heave? That comes as a result of picking 200 feet as the span, you see.

If you wanted to have a frost heave with larger deflections, which you may very well get, then the length of the pipe which would be involved in that would be much more than 200 feet, you see. This is why we ended up with only 3 inches, 2.7 inches.

Q Mr. Mirosh, you discussed in the first page of your prepared evidence in this panel, the matter of single river crossings as opposed to dual river crossings, and you use these words in the answer to question 3: "A single crossing at these two locations will not only be as effective but will in addition reduce river bank and river bed disturbances". It's the words "as effective". By those words, are you intending to mean as secure, or what is it that you mean by them?

I say that because if you intend to convey the meaning that it will carry the same quantity of gas, well then I suppose there's no dispute about that. What is it that you mean by the words "as effective"?

MR. MIROSH:

A Yes, I think security would be one element in the statement "as effective".

Q Sir, I take it that you

would agree with me that regardless of how selective you are in the choice of the crossing location, and regardless of the substantial engineering precautions, or the suitable installation methods to pick up phrases that you use in your answer, it may well be that Foothills might experience a failure at a river crossing, such as one of the/one of the Mackenzie River discussed in the paragraph.

A Was that a question?

Q Yes, it was.

THE COMMISSIONER: I think what Mr. Marshall is getting at is this, since you don't have dual pipe crossings at the river crossings, and you have a failure, say during break-up, there might be -- no doubt he's getting at this, there might be a two month interruption of the flow of gas to southern Canada. Is -- that's a scenario that you couldn't really argue with, assuming you did have a failure, and of course we understand that you don't intend to have any, but there it is.

MR. MARSHALL: I think you have been reading my notes, sir.

A Yes, I admit that I suppose any pipeline has a realm of possibility of failure.

Q Well, would you agree, sir, that if there's a dual crossing in the Mackenzie River, that there is an equal likelihood that one of the crossing -- that a single crossing line would go out of service, as there is a possibility that both lines in a dual crossing would go out of service at the same time?

A Well I suppose if you had two lines that were separated by considerable distance, several miles perhaps, you would reduce the possibility of losing both, but if you have a possibility of losing one, you have a possibility of also losing two which are close to each other.

Q Why do you have to be several miles?

A Well, whatever may cause the failure of a single crossing could also cause a failure of two crossings in close proximity to each other.

Q Well, if for example, it was a metallurgical defect, that notwithstanding the rigorous inspection procedures and so on escaped your attention that caused the failure, you wouldn't consider in such circumstances it would be likely that there would be two such failures in both lines of a dual crossing at the same time, would you?

A Well I would probably like to turn this area of questioning over to Mr. Walker, if I may.

Q Well I think I would probably like to get an answer from you, sir, because you have included it in your direct evidence, and I just want to know what you, as the manager of engineering at Foothills think --

MR. GIBBS: Sir, that was just a summary Mr. Mirosh gave at the opening of his evidence, and Mr. Walker certainly spoke on this in

detail and if he wants an answer, there's the man who we have to get it from.

THE COMMISSIONER: Before we go on, this is all hypothetical in a sense, but it has to be explored. Do you remember, Mr. Mirosh, the point you made about Arctic Gas' dual pipes? It is one that had occurred to me, that is if, owing to a severe condition of ice gouging or something like that, one pipe were to be damaged and to break -- we're really speaking of external causes, I think -- then wouldn't they get both of them at the same time so what's the good of dual pipes.

How far apart did Arctic Gas say its pipes were going to be? If you don't know, I'm sure we can ask Dr. Clark, but I've forgotten.

A I believe it's over one river width, but perhaps that can be --

MR. MARSHALL: I think that's correct.

A -- which is not a very great distance.

THE COMMISSIONER: One river width, well that could be a mile at the Mackenzie crossing, couldn't it?

A I believe it's just under a mile.

THE COMMISSIONER: What about the Shallow Bay crossing? That's a crossing of -- where the width is four miles. Was it intended that the -- you could answer this, Dr. Clark, if you don't mind, was

it intended that the dual crossing at Shallow Bay, the two pipes should be four miles apart?

DR. CLARK: Two hundred feet in Shallow Bay, sir.

THE COMMISSIONER: Two hundred feet apart?

DR. CLARK: Yes.

THE COMMISSIONER: And what about the crossing, say, at the east or Swimming Point?

DR. CLARK: One river width.

THE COMMISSIONER: ONe river width which would be about a mile?

DR. CLARK: About 4,000 feet.

THE COMMISSIONER: And what about Fort Simpson?

DR. CLARK: One river width there about 4000 feet.

THE COMMISSIONER: Well Mr. Gibbs had urged you to direct that question to Mr. Walker, I think and you had said no, you wanted Mr. Mirosh to answer.

MR. MARSHALL: Well if he doesn't know, sir, that may well be his answer. It's in his evidence and because of his position with Foot-hills, I wanted to get his answer specifically.

MR. MIROSH:

A Well could you restate the question and I might try?

THE COMMISSIONER: Does anybody in the hall know what the question was?

MR. MARSHALL:

Q I guess it really boiled down to this, sir, wasn't there really less chance of two failures at the same time, than of one failure?

A Well I think one should look at it from the other way and try and install a river crossing which would not fail whether it's one or two.

Q Well assume both had been installed in such a way that the best judgment of the engineers concerned neither would fail, well surely there's got to be less chance of both of them going out than there is of one of them going out?

A I'm not certain of the probabilities of that, but I suppose I could add that one thing we have done in taking a single approach is bury the pipe deeper than the dual pipeline approach in the river bed.

Q What is your criteria for burial, sir?

A Well we had a hydrological calculation performed on scour, anticipated scour under maximum anticipated flood conditions. I don't recall -- perhaps it's 25 feet at Swimming Point which is the burial depth, and I think the scour calculation was 15 feet.

Q Well perhaps you could check your records, and if you find that's not correct, you can let me know through Mr. Gibbs.

A Yes.

THE COMMISSIONER: Is that 25 feet to the upper, the top of the pipe?

MR. MIROSH: The top of the pipe at the bottom of the river bed.

THE COMMISSIONER: Well we have been at this a couple of hours this evening. Maybe it would be best to knock it off for now, and we'll adjourn then and carry on at 9 in the morning.

Before we adjourn, Miss Hutchinson, would you see that copies of exhibit 225 and 226 are sent to Mr. Arion the President of the Chamber of Commerce in Fort Simpson, to Mr. Reesor and to Mr. Sigler, who is counsel for the municipalities. They are some fairly recent data that they may not pick up in the transcript, but I think they should see that material.

MR. GIBBS: Mr. Commissioner, might I inform yourself and my friends that I may have to set my metallurgical panel a little later in the order because of the difficulty of getting one of the witnesses. I hope not, but we may have to set it back.

THE COMMISSIONER: Certainly. Well, we will adjourn until 9 in the morning, and we'll sit tomorrow morning and tomorrow afternoon, but we won't sit tomorrow evening.

(PROCEEDINGS ADJOURNED TO TUESDAY, SEPTEMBER 16, 1975 AT 9:00 A.M.)